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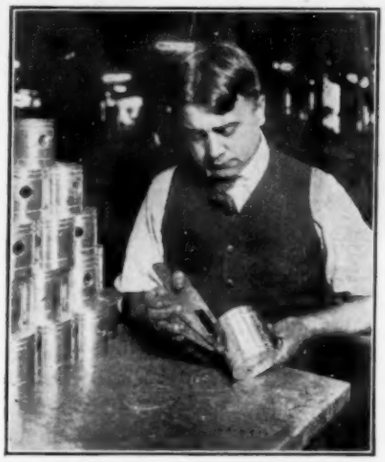


Automobile Engine Pistons as a Stock Proposition

By ELLSWORTH SHELDON
Associate Editor, *American Machinist*

The making of pistons and other small parts for automobile engines, as a business entirely aside from the manufacture of the engines themselves, has grown to very large proportions within the last decade. In this article some of the tools, fixtures and machines, used by one large manufacturer of engine parts, are illustrated, and many of the operations described.

WHEN the cylinders of an internal combustion engine become worn to the extent that a machining operation is necessary to restore them to their original degree of efficiency, it also becomes a practical necessity to refit the enlarged cylinders with new pistons; else most of the benefits to be derived from the repair will be lost, and conditions will be introduced that tend to loss of energy and rapid wear.

While there are repair shops, garages, etc., that will undertake to rebore or regrind a block of cylinders, the making of new pistons involves patterns, a foundry, and much special machinery ordinarily beyond the financial compass of the average small business, therefore the garage and service station willingly leave the production of these parts to larger concerns that by specializing upon the detail are able to put their operations on a manufacturing basis, and, producing the parts by thousands, reduce the individual cost to a fraction of what would be possible in the smaller shop, as well as to maintain a higher standard of quality.

Standard "oversizes" to which cylinders are reground are established by most manufacturers of automobile engines; these standards usually conforming to the scale adopted by the Society of Automotive Engineers,—0.010, 0.020, 0.030, 0.040 in., etc.,—over the normal sizes. This means that in grinding a worn cylinder, the grinder will stop at the nearest standard oversize after the cylinder has been made true and smooth.

The Houpert Machine Co., Long Island City, with the exception of a separate department for regrinding cylinders and crankshafts, devotes its attention to the manufacture of three small parts,—pistons, piston-rings, and wristpins. This company manufactures pistons for all standard automobile engines and, because of the established oversizes, is able to carry in stock, pistons to fit all motors, finished in practically every respect but the final grinding so that any order can be filled almost immediately upon its receipt.

Some of the machines, fixtures, and tools used by the company are described in this article, and also the progress of the work is followed from the receipt of the castings to the issuance upon order of finished pistons. The sequence of operations is somewhat dependent upon the design of the piston being operated upon.

The castings are received at the raw stockroom which is so situated that an automobile truck may back up to the receiving window. The shutter of this window turns down and inward so that when let down upon

FIG. 1. RECEIVING ROOM FOR CASTINGS

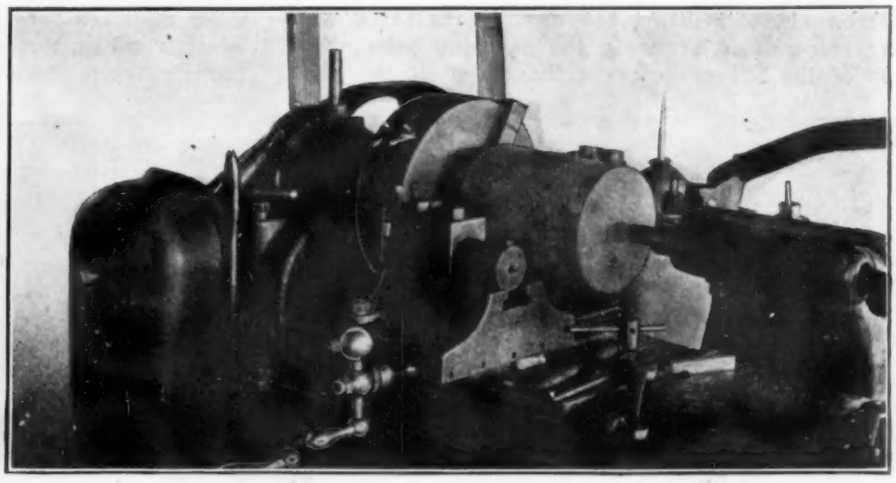


FIG. 2. CENTERING CLOSED END ON PORTER-CABLE LATHE

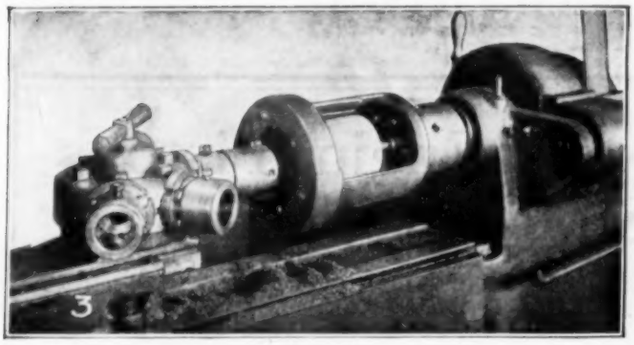


FIG. 3. BORING THE SKIRT

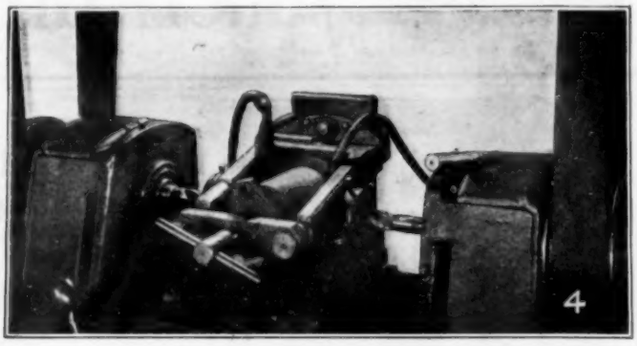


FIG. 4. DRILLING WRISTPIN HOLE

its hinges it becomes an apron or chute upon which the load of castings is discharged. Fig. 1 shows this shutter open, ready for unloading the castings.

The first manufacturing operation on practically all pistons is the centering of the closed end. There is upon this end of all castings a small boss for the reception of the center and the boss is made high enough so that upon its removal in the final operation no trace of the center is left.

Fig. 2 shows a piston casting in a Porter-Cable lathe where the centering is done. After setting a casting in the chuck, the jaws of which true up the inner end, the outer end is made to run as true as possible by rapping it with a mallet while the operator turns the lathe by hand. The center is then drilled and reamed by means of a combination drill and countersink held in a slip chuck used on the tail center.

Operation two is the boring of the inside of the piston. While this operation is not absolutely essential to the running of an engine, it amply justifies itself by simplifying succeeding operations; besides it produces a better balanced piston, and also reduces somewhat the weight of the casting. This is an important consideration in the design of gas engine pistons for the reasons that excess weight in the rapidly reciprocating parts entails unnecessary loss of energy, and a light body radiates heat more rapidly than a heavy one. The operation is shown in Fig. 3.

The third operation in regular progression is the drilling of the wristpin hole. This is ordinarily done upon the special machine shown in Fig. 4, in a fixture that locates the work from the bored and faced skirt. A round steel plate at the base of the fixture has a narrow shoulder fitting the bore of the skirt, while a center-pointed screw in the swinging yoke at the top of the fixture bears in the center at the closed end of the piston, causing it to seat firmly upon the plate resting upon the faced end. A stud of suitable shape projects from the center of the bearing plate a sufficient distance to enter between the wristpin bosses of the casting and thus locate the pin hole at right angles to them.

A movement of the capstan wheel on the front of the machine now brings up a drill spindle from each side. The drills run at high speed and work under a flood of lubricant so that the cutting time is reduced to a minimum. The piston-pin holes are finished by boring with a single pointed tool at a much later stage when they can be located from the finished outside surfaces. The rough drilling is done at this time for two reasons: one being that the pin hole furnishes an important link of the holding devices used in subsequent operations, and the other because it is desired to remove as much superfluous metal as possible before the heat treating.

Not all pistons go to this operation at this stage. The machine shown in Fig. 5 has been recently installed, and is intended to drill, bore and ream the wristpin hole in successive steps at one setting. A four-position turret mounted upon a horizontal axis at the center of the machine has holding fixtures similar to those just described. As there are four positions and but three operations there is always an idle position from which the operator can be removing the finished work and setting in pieces to be operated upon. Aside from this unloading and reloading the action is automatic and the machine runs continuously.

The fourth operation in the regular sequence is the rough turning, performed on Gridley automatics. In these machines the tail center is not available as a locating and supporting medium, and it is at this stage that the rough drilled wristpin hole becomes essential.

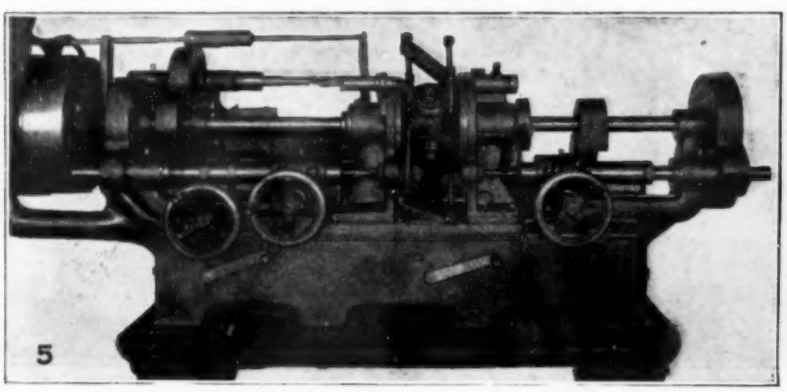


FIG. 5. THE HOEFER MACHINE FOR DRILLING, BORING AND REAMING THE WRISTPIN HOLE

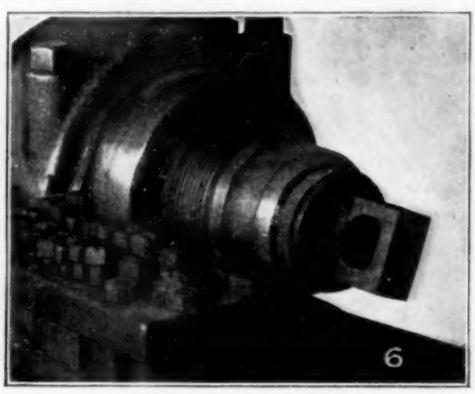


FIG. 6. DETAIL OF CHUCK ON GRIDLEY AUTOMATIC

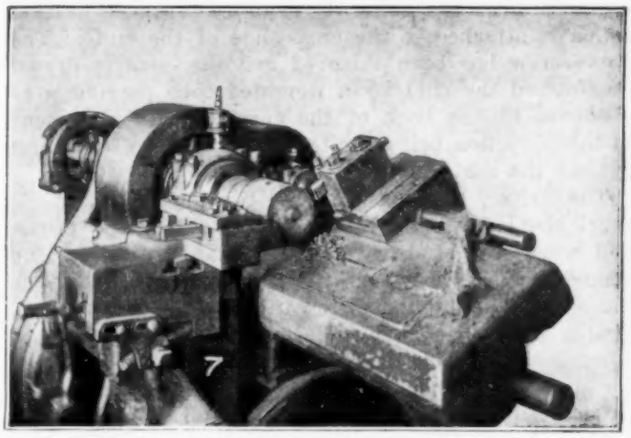


FIG. 7. THE SET-UP IN THE GRIDLEY MACHINE

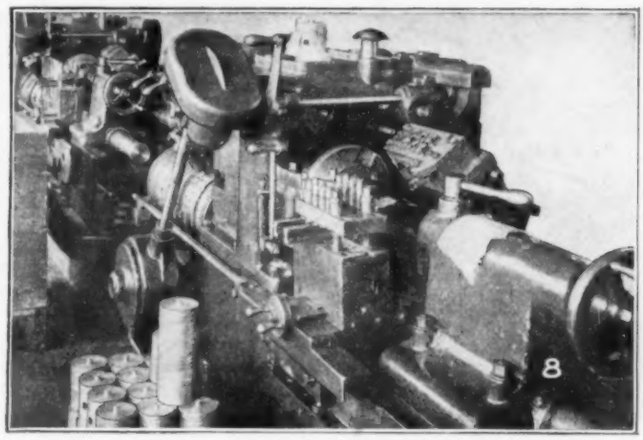


FIG. 8. THE FAY LATHES

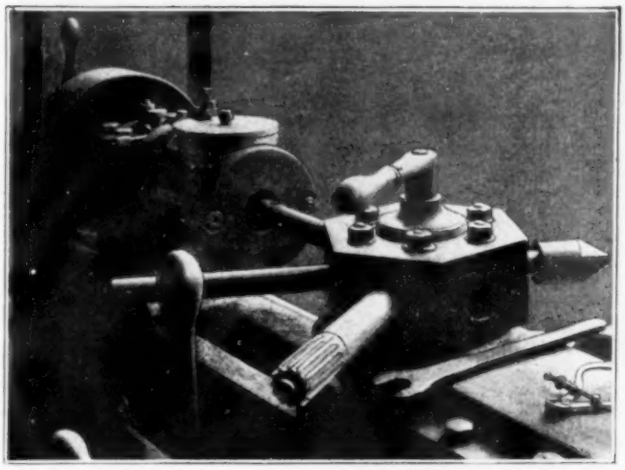


FIG. 9. BORING WRISTPIN HOLES IN TURRET MACHINES

The driver or chuck in this operation, shown in Fig. 6, is a round block somewhat smaller in diameter than the rough-turned size of the piston it is to hold, with a narrow shoulder fitting the bore of the work. A draw rod of rectangular section projects from the center of the chuck far enough to enter between the pin bosses; a cross hole in the end of the bar lining up approximately with the rough-drilled hole in the piston.

A plug is pushed through the holes in piston and draw rod and the latter drawn back by means of the handwheel at the outer end of the spindle. This provides a rigid hold on the work and at the same time leaves the outer or closed end free for facing. Fig. 7 shows the set-up on the Gridley machine. In this operation the diameter is turned to within ½ in. of finished size, the closed end is faced and the ring grooves roughed out, leaving stock enough to finish in the final operation.

New castings of iron when subjected to high temperatures have a tendency to swell, or become permanently enlarged, and if an engine piston is placed in service without a proper seasoning, it is quite likely to stick and cause all kinds of trouble. For this reason manufacturers of such parts subject them to an annealing process which in the present case is done in a gas furnace. This annealing is the fifth operation and follows the rough turning.

Following the annealing is the finish-turning; operation six. For this a battery of Fay lathes, one of which is shown in Fig. 8, is provided. These machines bring the pistons to their finished size plus grinding allowance. The holding and driving device is much the same as on the Gridley machines, except that the central driving stud is fixed instead of being a part of the draw rod and no pin is necessary. This is because the Fay lathes are provided with tail spindles and the work is held between the driver and the tail center.

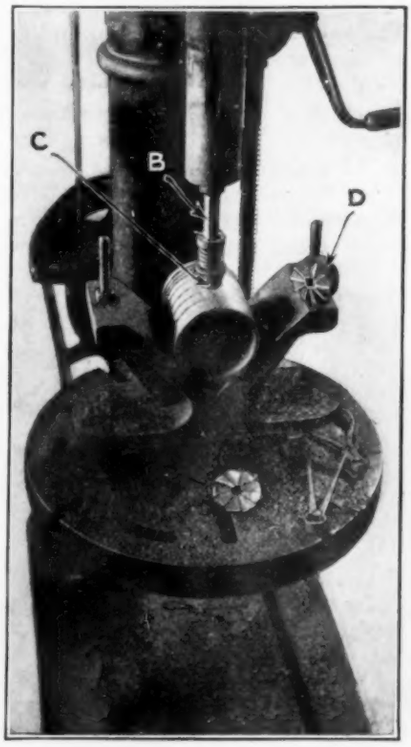


FIG. 10. RIG FOR FACING INSIDE OF PIN BOSSES

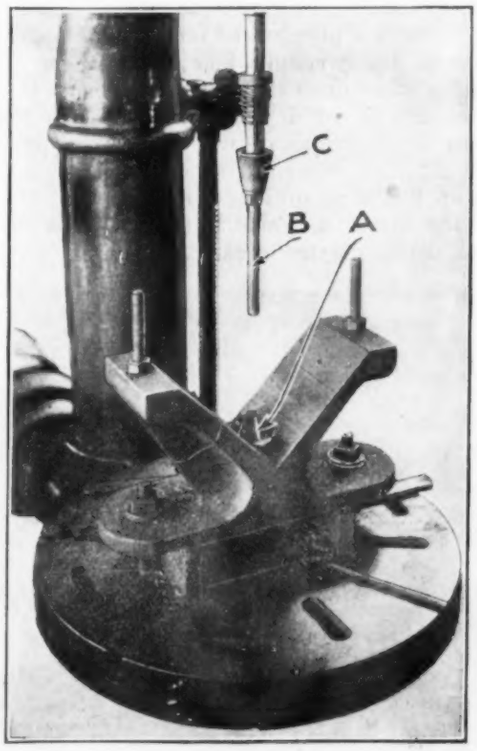


FIG. 11. FACING INSIDE OF PIN BOSSES

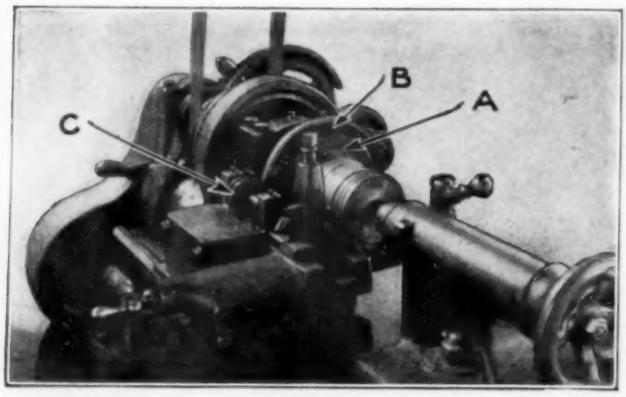


FIG. 12. THE RELIEVING DEVICE

From the finishing lathes the work goes to a turret machine shown in Fig. 9 on which the wristpin hole is bored with a single-point tool to insure that it is absolutely square with the axis, and exactly in the center of the piston.

The inside faces of the pin boss are finished on the drill press, the fixture being shown in Figs. 10 and 11. A piston is laid in the V with the cone shaped spring plunger A, Fig. 10, entering the hole in the lower side. The plunger is hollow, being accurately ground both outside and in, and forms a bearing for the boring bar *B*. A spring-supported, cone shaped bushing *C* on this bar enters the hole in the upper side of the piston and together with the lower cone centers the bar in the hole. A loose face-mill *D*, Fig. 11, is slipped on the lower end of the bar as the latter is passed through the piston and, being held to the bar by a feather and backed up by a shoulder on the bar, it mills off the surface of the boss to an amount determined by a stop on the drill-press spindle. The bar is withdrawn and the piston turned over to mill the other boss.

There is a pronounced tendency of pistons to "swell" around the wristpin hole and become oval, causing undue wear upon the cylinder walls at this point. To overcome this, it is customary to relieve them over this area by cutting away the surface to a depth of perhaps $\frac{1}{32}$ in. The relieving device is shown in Fig. 12 and is applied to an ordinary engine lathe.

The driver *A*, which screws upon the spindle nose of the lathe, carries a cam *B* upon its periphery which contacts with the roller *C* mounted upon a bracket which is attached to the cross-slide of the lathe. The cross-screw has been removed and the slide is drawn in (toward the cut) by a weighted cord passing over a sheave at the back of the carriage; its movement in this direction being limited by the roller *C* stopping against the cam.

The driver, like those on the turning lathes, has a short shoulder fitting the bored "skirt" of the piston and a central stud with flatted end projecting far enough to pass between the wristpin bosses. Thus the act of putting the piston in the lathe trues it up, locates it to bring the relief at the right place and furnishes the means of driving it without the necessity for a dog or other positive means of holding. The outer end is supported by the tail center.

The cam *B* which appears in the picture to be round is not so in fact, but has two depressions not more than $\frac{1}{8}$ in. deep which correspond to the positions of the piston that brings the ends of the piston-pin hole toward the tool. The roller *C* runs on a long stud upon which it is free to travel lengthwise, thus permitting, within limits, the usual traverse for the carriage. The tool is under positive control of the operator by means of the compound slide. The relieving of a piston is therefore quite a simple matter as the rough turning would be; the cam allows the tool to cut where metal is to be removed and pushes it out of the way where the surface is to remain untouched. Fig. 13 shows a piston after the relieving operation.

FIG. 13. A RELIEVED PISTON

Several minor operations follow. The bosses are drilled and tapped for the setscrews that hold in the piston pins, and drain or "weep" holes are drilled around the circumference of the piston, starting from

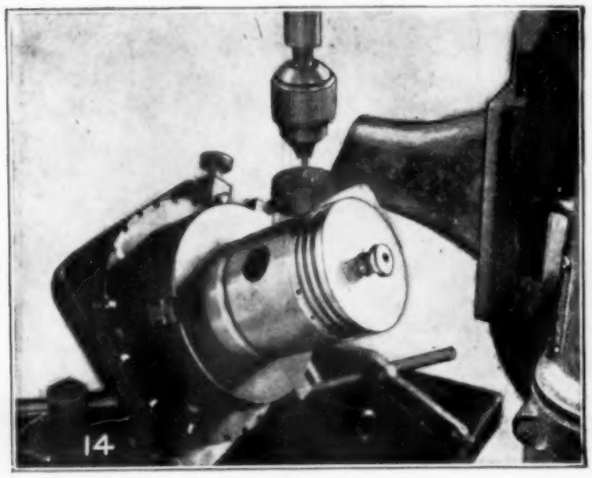


FIG. 14. DRILLING THE WEEP HOLES

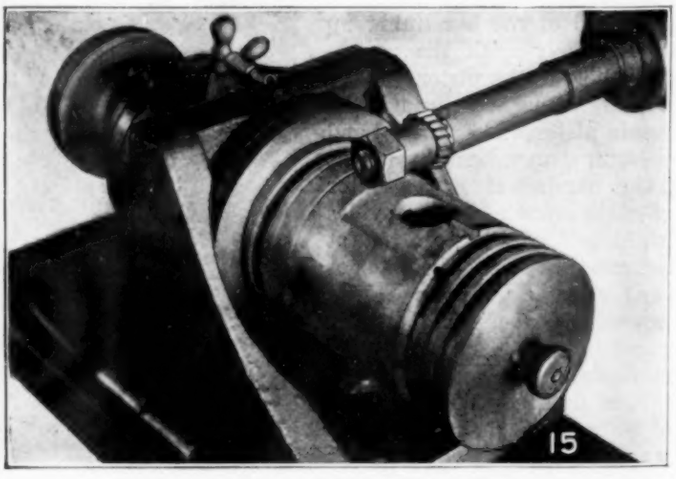


FIG. 15. MILLING OIL GROOVES

the angular side of a groove which was cut there for that purpose just below the ring grooves. The holes allow any surplus of oil on the cylinder walls to drain back through the interior of the piston and help to prevent an accumulation of carbon by keeping superfluous oil out of the upper part of the cylinder.

In the fixture shown in Fig. 14 a universal chuck is mounted on the upper end of a spindle which is supported by the base casting at an angle of approximately 40 deg. Below the chuck, and keyed to the spindle, is a dial plate having its outer edge notched to receive a locking-slide by means of which any desired number of holes are equally distributed around the circumference of the work. The fixture when photographed was not in drilling position.

Besides these holes there is a shallow but wide groove leading from the angular groove down to the end of the wristpin, for the purpose of conducting oil to, and through, the hollow pin to the wrist bearing. The set-up for this job is shown in Fig. 15 the work being done on a hand milling machine.

Operations in a New Orleans Foundry

By Frank A. Stanley

The photographs herewith illustrate some of the operations of a New Orleans foundry engaged in the production of sugar machinery.

The greater part of the work of this firm is of a very heavy character and much of it is loam molding in which the cores and molds are swept up by striking boards or sweeps. The sweeps are made of rigid metal striking bars or spindles held vertically in heavy brackets with suitable bearings and carrying adjustable arms to which the boards are bolted for various sweeping operations. A view of such work is shown in Fig. 1. Most of these molds are made up of brick and loam with a certain amount of clay in spots. The

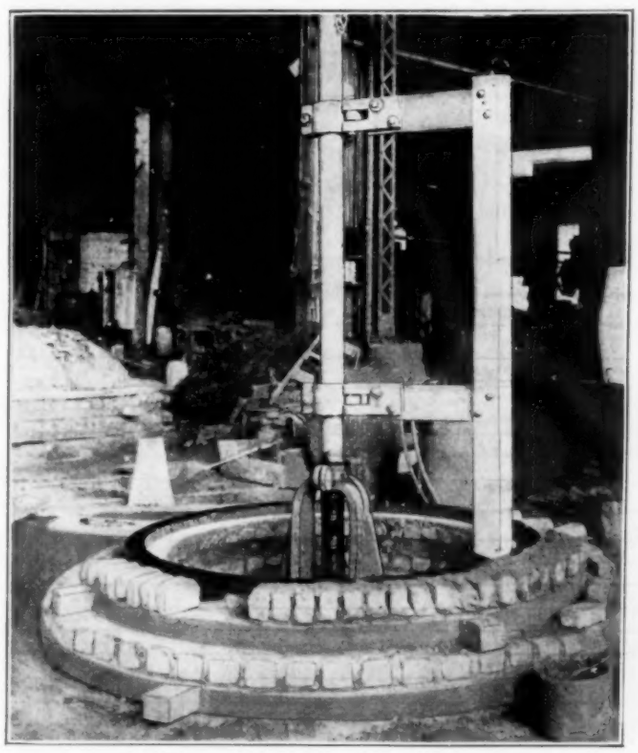


FIG. 1. THE SWEEP IN POSITION

FIG. 2. A COMPLETED LOAM MOLD AND ITS CORE

sand or loam inside, the brick mold is usually ¾ to 1 in. thick, and commonly loam is used as a binder for holding the bricks together. The building up of the mold by the sweeping process is followed by baking over night in big core ovens, the whole brick mold being picked up bodily by overhead cranes and transferred to cars which are run into the ovens.

In molding big rings, drums, cylinders and the like the brick and loam work is built up and swept to any desired height and diameter and both molds and cores are handled advantageously in this manner. Fig. 2 illustrates a completed loam mold and the core, which has been swept to proper dimensions.

An Interesting Molding Job

A job of special interest is represented by Figs. 3 and 4. This is the molding of a cone-shaped casting which is part of a calandria vacuum pan. The casting is of brass and its diameter is 13 ft. or more, depending upon the size of vacuum pan manufactured. In the conical face of this casting there are cored over four hundred 3½-in. holes, which are afterward machined to receive the ends of short copper tubes connecting two of these cone castings together in the assembled vacuum pan in much the same manner as tubes are placed in a boiler. The cone casting in the 12- or 13-ft. size is about 6 ft. high. The thickness of the metal in the wall is about ½ inch.

The lower half of the mold, Fig. 3, is built up first, loam and sand being used over a brick center and the cone swept to dimensions ready for baking in the oven. This cone is used as a core or center for

FIG. 3. PART OF A MOLD FOR A VACUUM PAN

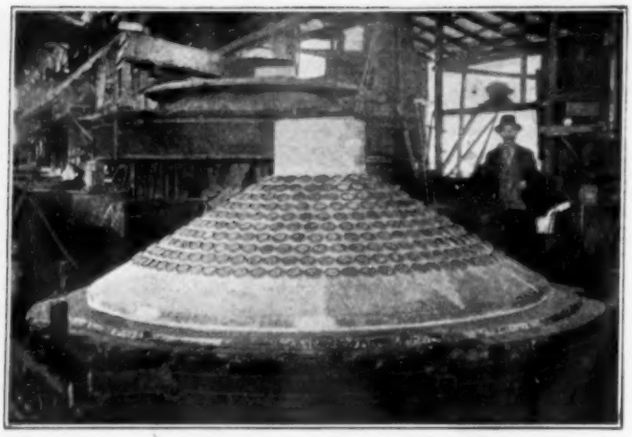


FIG. 4. OVER 400 CORES IN PLACE

the molding of the upper half of the mold, and for this purpose a half-inch thickness of sand is left all the way round on the lower cone to represent the thickness of metal to be run. The top half of the mold is placed in position and molded to the lower cone.

Afterwards the half-inch of extra sand thickness is swept off the lower cone and the latter is scribed with a series of lines around its surface for the accurate placing of the 3½-in. cores to form the openings through th walls. These small cores are dry sand, baked as usual, and are positioned as shown by Fig. 4, where they may be seen in ten circles around the cone.

When the top of the mold is placed in position the metal is poured through the neck and flows down over the sloping cone. About 3,700 lbs. of metal is run in this job.

The operations illustrated are from the plant of Dibert, Bancroft & Ross, New Orleans, La.

Cost Keeping in the Small Shop

By Fred H. Colvin
Editor, *American Machinist*

The reason many systems fail is because people expect them to run themselves. This is particularly true of the small shop. While the perfect automatic system is yet to be invented, the one shown herewith has worked out well in a small shop and is worth looking over.

While cost keeping may be said to be one of the great problems in all industries it is particularly true of the small shop, where clerks are a luxury and most of the time-keeping devolves on the boss and the men. Direct costs are of course based on labor and material, and while these are not always as simple as they seem it is the indirect expense that gets the small shop into difficulty.

Then, too, the question of how a bill shall be rendered is well worth careful consideration as the psychology of the one who is expected to pay it must be taken into account. Many demand an itemized bill, and this extends up to one of the wealthiest men in the world, who requires an itemized account from his physicians and specialists.

There are two sides to this question, however, and some are opposed to it for various reasons. You have a certain job to be done—it costs you so much money, using necessary material and labor. Why, say some,

Overhead

Billed

Entered

Folio

Contract Price

JOB ORDER

WALSTAD MACHINE CO.

*Job No.*_____

*Tacoma,*_____

*CHARGE TO*_____ *Address*_____

*Req. No.*_____ *Promised*_____ *Finished*_____ *By*_____

INSTRUCTIONS:

PIONEER R'D'G & P'TG. CO., TACOMA-W.567

LABOR							MATERIAL						
DATE							QUANTITY	DESCRIPTION	REQ.	COST	SELL	AMOUNT	
TOTALS											TOTAL		

Hours @ _____
Hours @ _____
Hours @ _____
Hours @ _____
Total Labor _____
Total Material _____
Sundries _____
Total _____
Charge _____

FIG. 1. JOB ORDER BLANK

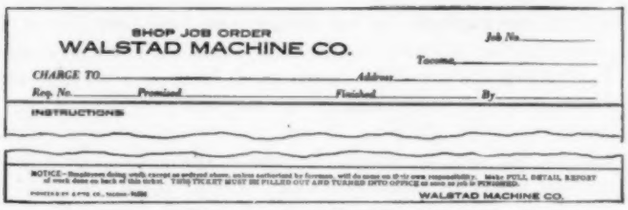

SHOP JOB ORDER
WALSTAD MACHINE CO.
Job No.
Tacoma,
CHARGE TO
Address
Req. No. Promised Finished By
INSTRUCTIONS
WALSTAD MACHINE CO.

FIG. 2. SHOP JOB ORDER CARD

itemize every bolt and screw? If there is to be complaint as to cost it might just as well be as to whether a new bolt was needed as to question its cost.

It often happens that a job needs a single bolt which ought not to cost over five cents at any hardware store. And yet that bolt may have cost the small shop man fifty cents or more, because he had to send a man or boy down town, or elsewhere, to get it. Yet if anyone sees a charge of fifty cents for a five cent bolt the wail against the profiteer will be loud and deep. Of course the extra forty-five cents might go in as labor, but it really belongs in overhead, which few small shop men know how to figure.

Some shops have come to believe that the most satisfactory method is to bill something like this: To reboring cylinders, replacing four piston rings and two piston pins; grinding valves, cleaning carbon, assembling and turning motor—$43.65, or whatever the charge may be.

But whatever the method of charging or billing the small shop needs a cost-keeping system, and the one used by A. N. Walstad of Tacoma, Wash., seems to fill the bill.

First comes the "Job Order Sheet," Fig. 1, which is 11¼ x 10¾ in. and fits into a loose leaf binder. This is the office record, on which is noted each day the time and material which have been charged against this particular job. These items come from the individual time slips which are shown in Fig. 4.

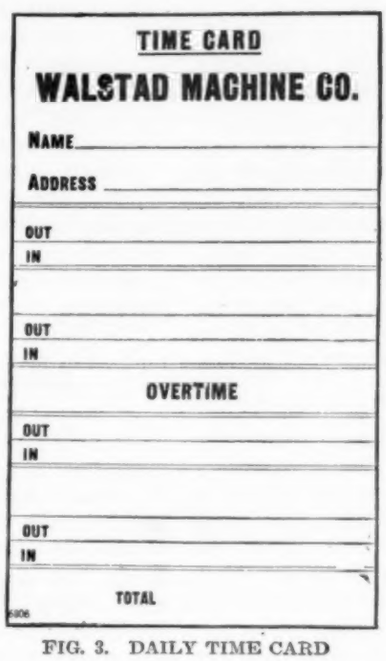

TIME CARD
WALSTAD MACHINE CO.
NAME
ADDRESS
OUT
IN
OUT
IN
OVERTIME
OUT
IN
OUT
IN
TOTAL

FIG. 3. DAILY TIME CARD

The "Shop Job Order," Fig. 2, goes into the shop. This gives the number of the job for the time slips, tells them briefly the conditions as to delivery and contains any special instructions which may be necessary. The workman makes a full report on the back of this slip for the information of the office. This order slip is 5 x 8 in. for card files.

The "Daily Time Card," Fig. 3, is a 3 x 5 card size and covers the time spent each day in the shop. It is stamped on time clock, "in" and "out" in the usual way, with allowance for overtime in case more than eight hours are worked in the shop.

The last form is a 5 x 8-in. card and is the "Individual Time and Material Slip." It is stamped in at the same time the man starts to work in the morning and is only used for one period of work on one job. If the workman works an hour on the first job he stamps his time in and out, and makes out a new card for the second job. If he works on the same job four times in one day he has a card for each time, four cards in all. When he stamps "out" on a card he is through with that card and it goes into the office.

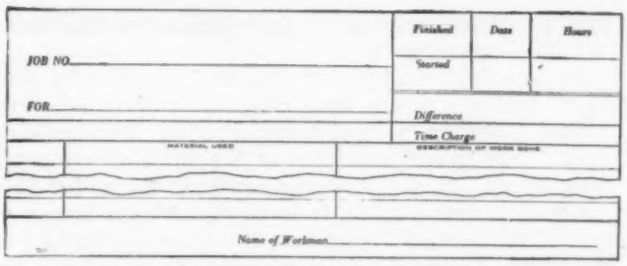

JOB NO.
FOR
Finished
Date
Hours
Started
Difference
Time Charge
MATERIAL USED
DESCRIPTION OF WORK DONE
Name of Workman

FIG. 4. INDIVIDUAL TIME AND MATERIAL SLIP

If he worked on one job all day he would have two cards, one for each time he stamped in and out. In any case the sum total of his various time and material slips must equal the time charged on his daily time slip, Fig. 3.

One of the leaks in a small shop is in overlooking to charge for material used, especially small stuff such as screws, solder, etc. When these individual time and material slips come to the office they are looked over to see that all material has been charged. If it is a job of soldering there should be a charge for solder and acid or paste, and so on. These small items count up in many cases.

When a job is completed all the individual time and material slips, Fig. 4, are taken from the card index file and filed away with the shop job order, Fig. 2. The large job order is also removed from the daily job book and filed away in a loose leaf binder for future reference.

The daily time card for each man is filed away every day after the time has been entered in the time book from which the pay roll is made up. This system, with only four different blanks, has worked out very well in practice under varying and trying conditions. It is so much better than anything used before that Mr. Walstad wishes others to benefit by it, should it seem to fit into their business needs. Of course, different kinds of business will require different forms or routine, but the principle remains unchanged.

Combining Quantity Production with the Making of Special Parts

By Peter F. O'Shea

There are many machine shops in the United States which have developed their business from individual jobs made to suit each customer's needs rather than from a large and steady output of a standardized product. After such a shop becomes established as a factory for its special kind of product, the trade is apt to continue wanting that product, but with changes and variations. Provision is therefore made in such a factory for putting through orders for one or a small lot of the products with variations to suit the customer's needs. This is especially true of builders of machine tools. In fact, machine tools to meet special needs are really "built," rather than manufactured, speaking in the quantity sense. Efficient shops doing this sort of

work generally devise ways of combining manufacturing and building methods.

An excellent example of this is in a certain shop which makes machine tools adapted to the customers' special needs on a semi-manufacturing, semi-building basis. The hybrid character of the work affects every department. It starts in the drafting room, for in a business of this nature, it is there that the layout of special parts must be made. The drafting force has, therefore, analyzed the component parts of all the machine tools made in the plant and divided the parts into two classes—like parts, which are the same for all machines of a given catalog number or style, and unlike parts, which must be changed for each job to get the different features wanted. By far the greater majority of parts are like parts, and these are drawn up into standard lists, one list being made for each style of machine tool. Spaces are provided for quantity, part number and a brief description, as shown by the accompanying extract from a parts list.

The "like parts" and "unlike parts" lists for each style of machine are typed on tracing cloth. Blueprints are taken of the tracing, and whenever an order comes in for a variation of that style of machine, one blueprint of like parts is issued with the order, and serves as a requisition. If from time to time changes are made in the specifications of parts for that style of machine, corrections are made on the tracing itself. The blueprint requisitions are issued from the drafting room, which is also the office of the chief engineer. He knows at all times just what work is to be done, and prescribes the necessary parts. He fits special layout of parts in with the standardized methods of suspension, drive, etc.

Method of Manufacture

The like parts are either made on large orders for stock, or purchased and held in stock. Separate orders are issued by the production department for the manufacture of sufficient quantities of each part for stock, the making of the parts most in demand being a real manufacturing proposition. The production department, in conjunction with stores, is responsible for always having a stock of them on hand.

Some of the like parts, however, are alike for only one style of machine, not for several. The number of orders coming through for that style of machine may vary from month to month, and it is difficult to make a large supply of some of the heavier part without tying up a good deal of money on the stock shelves. Therefore, the orders for these parts are put through only when the demand for them for the coming month is approximately known. Although they are "like" parts and do not have to be specialy designed, the scheduling of orders for making them is closely tied up with the delivery date for the special parts. They are to meet the special parts on the day the latter are completed, and when both are ready, then the ordinary "like" parts are drawn out of stock and all three kinds assembled into machine tools.

The superintendent controls the starting of manufacture of each part by means of a cabinet beside his desk. In the cabinet are placed envelopes holding the orders for special parts, or orders for the making of like parts, or a list of stock parts needed for the order, that is, a copy of the blueprint list of stock parts to complete the machine order. All the envelopes pertaining to one order of machines are put in the same pocket of the cabinet, or "board." To start the making of one of the components of an order, the envelope for it is given to the foreman concerned. Thus, as soon as a part is started, its envelope disappears from the pocket, and envelopes still remaining in the pockets denote that parts have yet to be started. If one pocket has become empty except for one envelope, it means that the assembling of that order of machines may be held up by the lack of one part. The superintendent, of course, gets after that order.

The Scheduling Board

In scheduling the work, a month is used as the unit of time required. This does not mean that it needs to take a month to build an order of machines, by any means. It simply means that the superintendent aims to clean up his work once a month. Several days before the end of the month, therefore, he takes a look over his board to see what envelopes are still remaining in the pockets.

The board is a visible index of the condition of the factory with regard to preparedness to meet new orders. The material can easily be followed through the shop by the superintendent and is not allowed to lie idle or accumulate, but must keep on moving. At the end of the month the board is empty and is refilled with orders for parts scheduled for completion during the new month. Each month envelopes accumulate in a large separate pocket for "orders due next month," until it comes their time to be distributed. Many of them are issued to the shops and are being made ahead of schedule.

The manner of recording drawings also fits in with the method of manufacture of a semi-special, semi-standardized product. In a machine design room or machine shop it is a habit of mind to speak of an article somewhat as follows: "Don't you remember that part we made specially for So and So? It was so good that we afterward used it regularly." Therefore, in the shop being considered, the title-legend in the corner of each drawing bears a notation of the firm for whom that design was first made. All the original correspondence and data, with possibly the reasons for the design in preference to another, will be available under the correspondence with that firm.

TYPE OF PARTS LIST USED FOR SCHEDULING PARTS

Description	Part No.	PC	PCS In	PCS Wanted	Purchase Order No.	Purchase Order Date	Purch se From
Unlike Parts—Iron Castings							
End plates for brg	B1213P	4					
Cone sh. lower brg	B1277P	1					
Loose pulley 19¼ dia	B1458P	1					
Tight pulley 20 dia	B1458A	1					
Pump pulley	B1593P	1					
Additional C'weights	B1749P						
Shipper fork	B1344P	1					
Shipper rod link	B1345P	1					
Cone sh. standard	C379P	1					
Shipper rod lever	C432P	1					
Belt fingers	C473P	2					
K. O. hand lever	C581P	1					
Add'l C'weights (bottom)	C636P						
Shipper rod bracket	C461P	1					

Production Records at the Hart-Parr Factory

BY A. W. SAWYER

The matter of keeping all hands busy and a constant flow of material moving in the right direction, toward the finished product, has always been a big problem in the factory, especially where the number of distinct parts entering into the completed machine or article approximate several hundred and possibly a thousand or more.

THE factory management of today, if it is conducted along successful modern lines, determines upon a certain amount of production for a given period, say one year, then sets the various wheels turning and the functions operating within the works to perform that allotted task. The amount of production is determined by the apparent future demand for the machine, the orders on hand and the company's ability to finance and produce. This is strictly a managerial problem and must be settled before production matters are undertaken in the works. In a big industrial establishment where the number of employees exceeds 500 and the work has been thoroughly divided into departments, the important matter left to be arranged for is synchronizing these departments in their respective functions so that each one is assisting all the others.

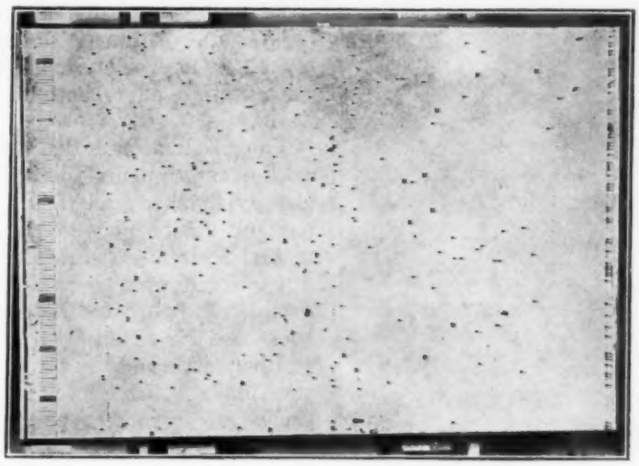


FIG. 1. THE PRODUCTION BOARD

To this end the Hart-Parr Company, tractor manufacturers of Charles City Ia., has established a thoroughly organized production department and, by a system of reports and printed blanks sent in each day from all producing centers of the works, the eye is able to discern at a glance just what progress is being made with the year's plan and in just what relation each necessary part stands to every other part, or in other words, is able to forecast and issue such orders as will cause the skirmish line of parts to form a solid straight line advancing in uniform order to the erecting floor or side bays where the parts become incorporated into the finished machine, which, by the way, should be moving toward the shipping floor during all stages of its building.

In the production office are four large boards, each about 2 x 9 ft. in size, hung on the walls by counterweights so that each board may be raised or lowered at will for convenience sake. As these boards are duplicated, in so far as their mission is concerned, but one will be described in this article.

Board No. 1 is designed to carry certain parts, arranged in units of assembly, for the production of 1,000 tractors. Boards Nos. 2, 3 and 4 are similarly marked. Tacks with various colored heads are used on all four boards to trace production through from one end to the other.

Let us now describe one board as to its markings, as it answers for all. Fig. 1 shows the entire board while Fig. 2 shows a small section enlarged so as to plainly show the markings. Parallel, horizontal lines, each line representing a tractor part, are laid out from one end of the board to the other. Each of these horizontal lines is divided by 1,000 equidistanced prick marks, each mark representing a tractor. Across these horizontal lines 10 perpendicular lines are drawn, 100 prick marks apart, thus assisting in the ready calculation by the supervisor of the boards. Assuming that tractor production has progressed to the number of 85 for that particular series of thousand lots, the right colored tack would be pushed into the prick mark midway between the eighth and ninth perpendicular lines and on the horizontal line standing for the finished products, either shipped or ready to ship. Of course if a 10,000 production is planned for, and later accomplished, these boards will be used ten times over.

In order to show the number of completed machines, let us proceed to set forth how, by the same methods, each individual piece in the tractor is, at all times, under the watchful eye of the production manager, who, by the glance to the right or left, in front or behind, may discern what part or parts are lagging on the skirmish line, thus allowing him to issue orders from time to time which will provide a steady stream of parts to the erecting floor. The working of these boards covers the entire time from the day when the material is checked into stores until the finished product is loaded on cars. By this method also the purchasing department is easily kept appraised of quantities of material on hand and is governed accordingly in purchasing more.

Different Colored Tacks

In order to trace this material from the raw stage through all departments until it reaches the shipping room, tacks of seven different colors are employed. These are used the same as the tack showing the number of the finished machines, except of course that the various colors are used on their respective lines describing the individual parts. Thus the yellow tack represents all purchased stock delivered to stores; black, all stock for the various parts which have been ordered by the purchasing department; white, all stock that does not require machining or previous attention; green, all castings, gray iron or steel, delivered to store house from the foundries. Brown represents all stock, either raw or in castings, delivered by the managers of the storehouse to the machine shop. Orange stands for all finished parts delivered from machine shop to manufactured stores which, in the case of the Hart-Parr Works, are bays located conveniently adjacent to the line of progressive production on the erecting floor. Any or

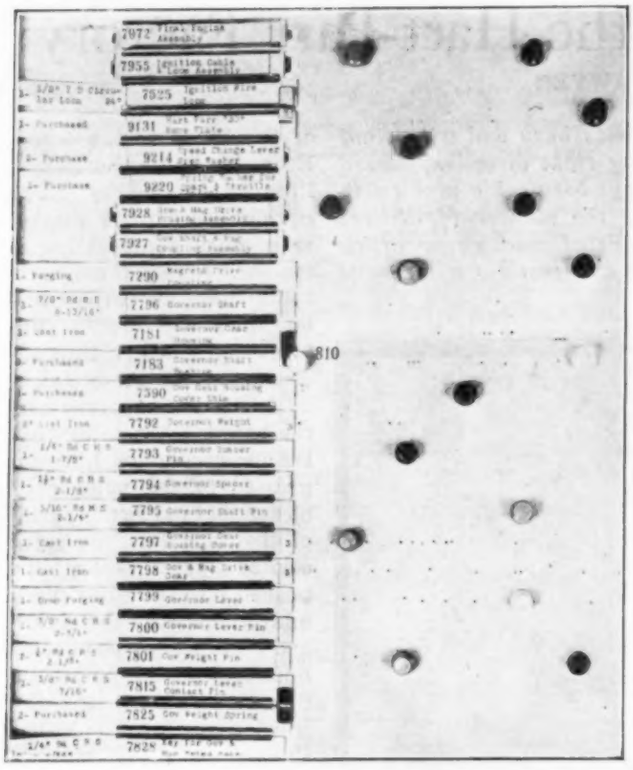


FIG. 2. ENLARGED SECTION OF THE PRODUCTION BOARD

all of these colored tacks may be found on the same horizontal line according as the reports sent in on any given part or assembly indicates.

To illustrate the practical workings of the boards, let us take a concrete example. For instance, the main cast-steel frame of the tractor. The boards, we will assume, are all being used for the first series of one thousand tractors. Then the green-headed tack may be set at the extreme right or end of the line carrying the name "Main Frame"—indicating that a sufficient number of them has been delivered from the steel foundry to build the series. If the number in stores is but a few ahead as reported by the storekeeper the foundry is notified of that fact and the tack placed at the correct number as a constant reminder of the situation. Then by the use of the brown, orange and blue tacks set on the "Main Frame" line accordingly as the daily reports indicate, this particular piece is carefully watched in its progress through the machine floor to manufactured stores and finally out on the erecting floor. Every other part of the tractor is watched with equal closeness, the result being that no sudden discovery is made that a certain part or parts have been thoughtlessly overlooked and the entire assembly floor paralyzed until the missing parts can be rushed to it.

This system for governing production may appear intricate at first but in reality it is very simple and worth each day many times over expense of installation. It must be religiously attended to, however, for the arrangement falls to pieces of its own weight unless carefully supervised and kept up to the minute from the reports sent in.

The management regards its production system as one of its best safeguards and could not be persuaded to discontinue it in the light of present knowledge applied to industrial management.

The system is also elastic and may easily be applied in whole or in part to any industrial enterprise. The color of tacks used is not arbitrary, only each office force must designate a special color for each specific purpose. No other system has been devised which so thoroughly visualizes the progress of parts through a factory.

To the machine shop foreman the production board shows all parts made ahead and permits him to work with the purchasing department in regulating the flow of material through the machine shop and it informs the foreman just what relation the machine shop bears to the schedule of tractors yet to be assembled on the erecting floor. It also discloses the quantity of material on hand going through the different operations in the machine shop. The system also takes care of all spoiled or defective parts both on the machine and erecting floors.

The production board, at a glance, shows the head of the experimental department the number of parts already finished and tells him when a new or changed part or device may go into effect without discarding material already manufactured.

The head of the repair department also seeks the production board for it tells him how many parts have been used for repair work by subtracting from the total number made and the total number of tractors built, the remainder being the number of parts or pieces used exclusively for the repair trade, and the same process shows the head of the repair department when the demand for any particular part is abnormally large, suggesting a weakness in it of some sort. This is reported to the experimental department and a remedy is immediately sought for.

The production board system has become very popular with all departments and although the boards are centrally located and easily accessible yet a number of the department heads keep boards of their own for their particular needs, thus avoiding loss of time and needless steps. This also provides a check between the central boards, hence error is readily detected.

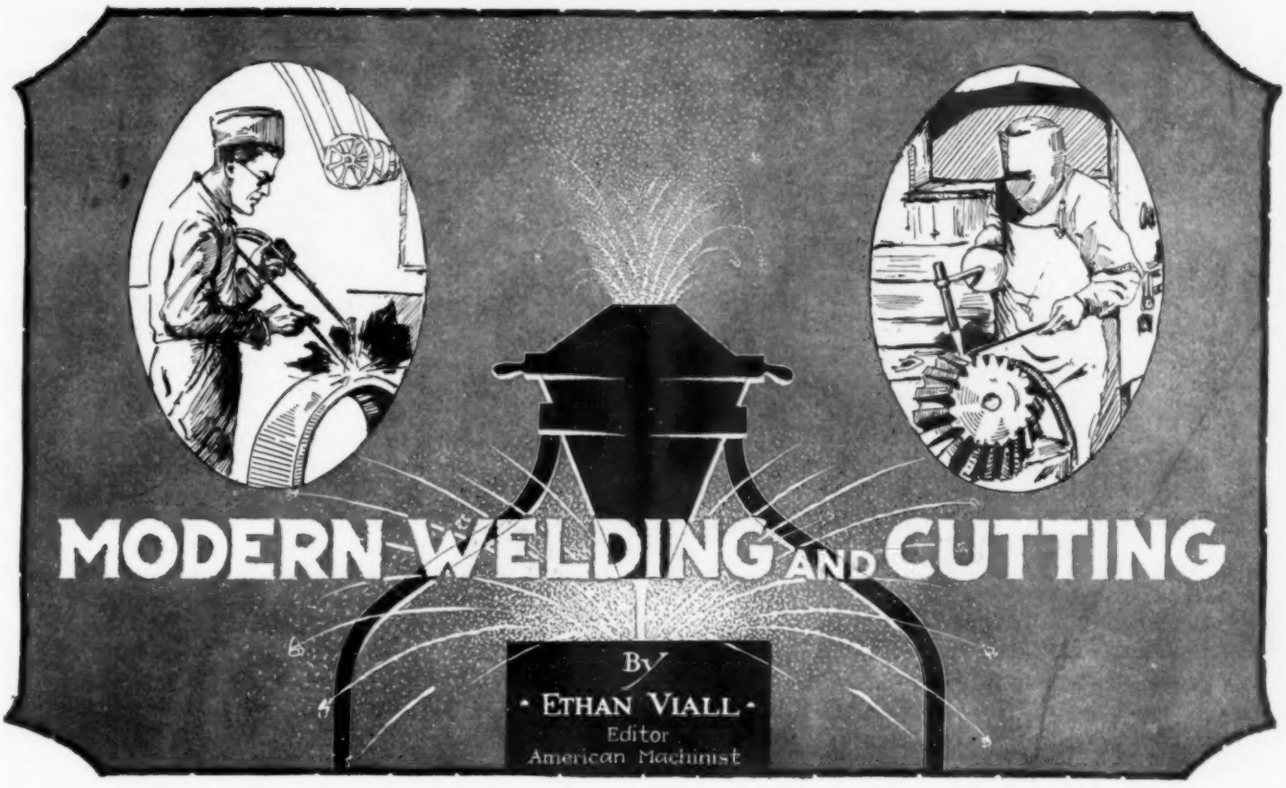
In a word, the production board system visualizes the condition of affairs, at a glance, an end that is both difficult and tiresome to obtain by turning the pages of the old fashioned records.

Using Worn Taps

BY S. E. FREW

When the teeth of taps become worn by use, the wear is mostly on the points. By grinding a tap, as in the illustration, along the line *AB* the original shape is preserved and it may be used for taking out the first cut in tapping new holes, and thus relieve a new tap of a lot of work, preserving the new tap for a much longer time than would be the case if the old one were to be thrown away and all the work put on the new one. The teeth should be ground with a slight clearance along the entire length of the threaded part, making the tap cut with unusual ease. If a grinding machine is at hand the tops of the teeth can be ground uniformly on the machine, afterward grinding the clearance by hand.

OLD TAP WITH TOPS OF TEETH GROUND OFF



THE layout and equipment of a welding shop will, of course, vary with the class and amount of work handled, the capital available and the personal opinions of the owner. One should, however, have enough equipment of a mechanical nature to insure the finishing of work in a reasonable time without too great an expense for labor.

A first class workman can, when necessary, turn out a good job of difficult work with a single welding and cutting outfit; means for preheating which may consist of a few firebrick, asbestos and charcoal; a chisel or two; a good hammer and a few files. These are insufficient, however, where any amount or variety of work is to be handled economically and to the satisfaction of the ordinary run of patrons. A minimum amount of mechanical equipment should include a number of hand and handled chisels, several hammers and sledges of different weights, a portable electric grinder or at least a grinding stand, and a portable electric or a stationary drilling machine, or both. To this, for more extensive work should be added a pneumatic or an electric chipping hammer, a lathe, cranes, and possibly a portable or a stationary motor-cylinder grinding machine. Oil- or gas-burning preheaters are also almost a necessity in any case, while a gas-burning preheater of the table type, will save an enormous amount of time and trouble on the general run of gasoline motor work. Special grated iron welding tables, heavy surface plates and grids, iron blocks and straps and numerous other articles will need to be added as local requirements dictate.

The shop layout for equipment will have to conform to the building unless the shop is built purposely for the work. In this connection very few suggestions of any value can be made, except that the shop manager should endeavor to so place his equipment as to cause the least running back and forth possible.

We will, for the benefit of our readers give the layout of a large shop doing nothing but welding work. This is the shop of the Oxweld Acetylene Co., Newark, N. J., and it was built expressly for this work. Allowance in position had to be made for the set directions of the railroad and street lines. Fig. 294 shows the end of the building next to the railroad. The overhead track for the chain blocks is so placed as to be readily used for loading or unloading either cars or trucks. This is good but a still better arrangement would be to extend the runway on into the shop itself and so save considerable rehandling in order to get the work to or from the welding floor. Fig. 295 is a floor plan showing the location of the various benches, lockers, machines, etc.

In Fig. 296 is shown a view of the shop just inside the northern end. The doors shown at the right are the ones that open out under the crane shown in Fig. 294. This interior view in Fig. 296 gives a good idea

XXIV. Welding Shop Layout, Equipment and Work Costs*

No set rules can be given for welding-shop equipment as conditions vary so greatly. There are a few things, nevertheless, that every shop should have. The general layout of a shop is as difficult to suggest as the equipment, and each owner must plan for himself to meet his special problems. However, regardless of equipment or shop layout, the owner of a welding shop must keep track of his costs, and two standard forms are given to aid him in this.

(*Part XXIII appeared in the July 8 issue.*)

*For the author's forthcoming book, Welding and Cutting. All rights reserved.

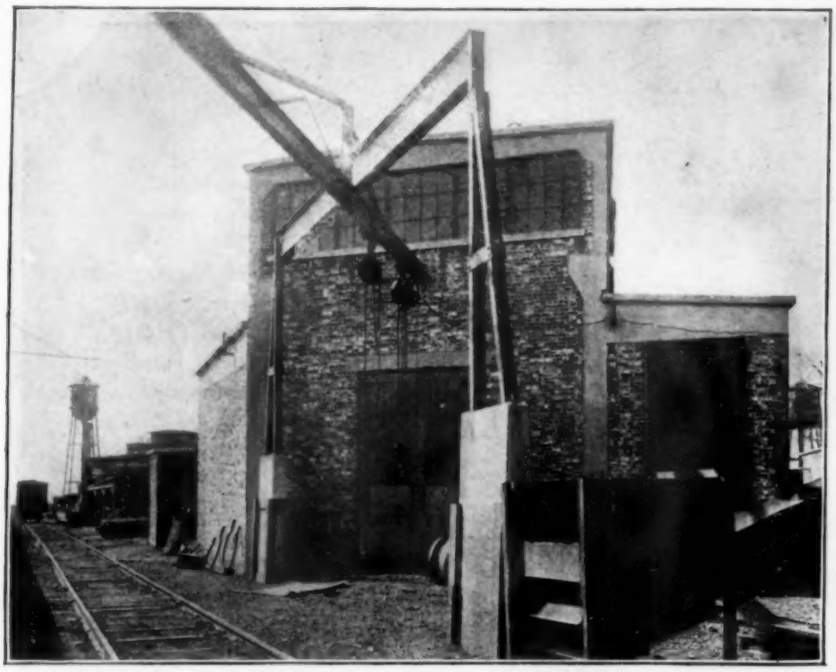


FIG. 294. EXTERIOR VIEW OF OXWELD SHOP, SHOWING CRANE HOISTS

of the lighting and the ventilators at the top for carrying away the fumes. The air and acetylene pipe lines are shown, and in the left foreground is illustrated the way cylinders are chained. In the central foreground one of the workmen is chipping a casting with a pneumatic chisel.

The opposite end of the shop is shown in Fig. 297. Here a portable crane is shown in the middle foreground. Suspended from it is a portable electric grinding machine. Just back of this is an electric grinding stand. At the right, in the background, is a Wiederwax preheater and just in front of this is an iron preheating and welding stand with an operator at work at it.

At the left in Fig. 298 is shown a number of welding tables with grated cast-iron tops and welded angle- and strap-iron legs. Both the daylight and artificial lighting are excellent throughout the shop. Probably no other shop would be built exactly like this, as conditions differ so radically, but a careful study will reveal to the prospective shop man some of the things that will, or will not apply to his particular case.

Keeping Track of Costs

No shop can succeed financially without keeping a close watch on cost of material, gas, labor, overhead, etc. The way this is done in the Oxweld shop will be seen by referring to the form shown in Fig. 299. This is so made as to cover both inside and outside jobs. These forms are made in duplicate on white and pink paper, so that a carbon of the original is made. These forms are for shop and office use only, and from them the customer's bill is easily made out. With forms of this kind, the entire data relating to any job may be had at any time by reference to the files.

Another form of cost card, suggested by the Imperial Brass Manufacturing Co., is shown in Fig. 300. This is not so complicated as the form just given, and will answer in many cases. The manager should not forget, however, to add to this the cost of overhead, which it is wise to make fairly high to allow for contingencies—say from 100 to 150 per cent.

Carbon Burning

While carbon burning has nothing to do with welding, the ordinary welding shop is often called upon to do such work on account of having a supply of oxygen at hand.

Carbon in a motor cylinder is caused by imperfect combustion. It may be that the carburetor was not adjusted so as to give sufficient air, or it may be too

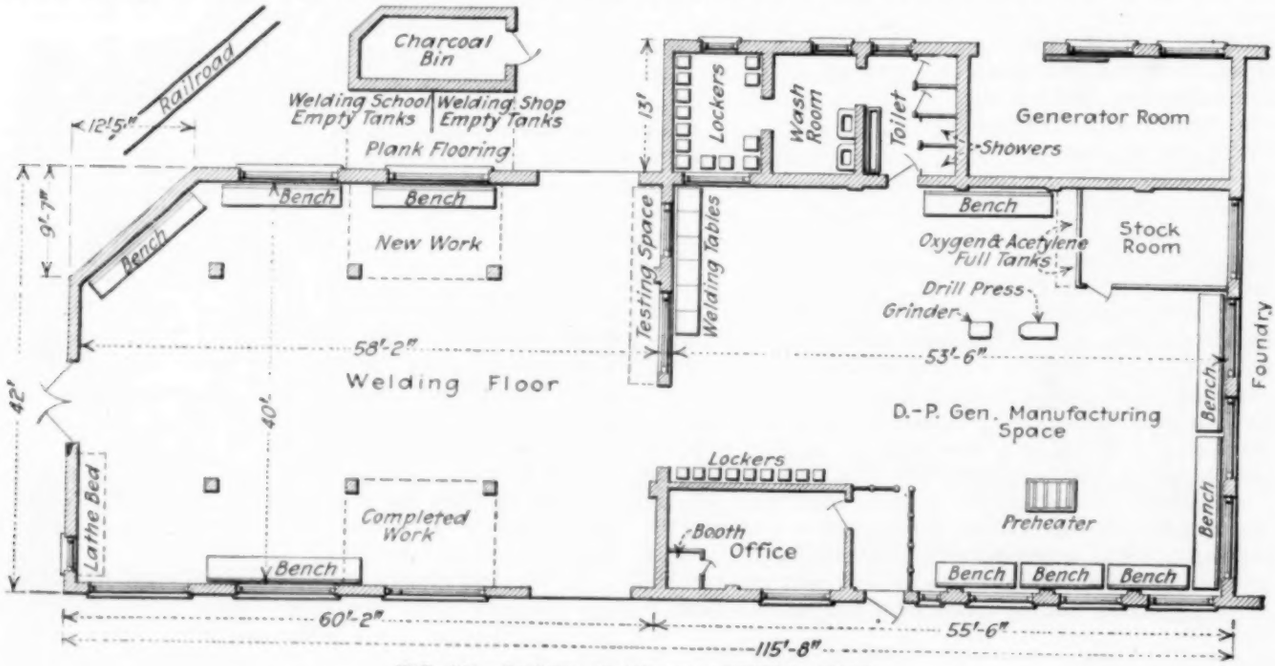


FIG. 295. FLOOR PLAN OF OXWELD SHOP

FIG. 296. INTERIOR VIEW OF SHOP

much oil was used. The use of oxygen is the most practical and thorough way to remove this deposit.

A Decarbonizing Outfit

A decarbonizing outfit is shown in Fig. 301. Here *A* is the oxygen tank valve, *B* the tank coupling, *C* the pressure gage showing the pressure at which the oxygen is delivered to the "torch," *D* the regulating screw, *E* hose connection, *F* trigger valve, *G* hose connection and *H* the flexible copper tip.

To use this outfit, connect it up as shown, then with the motor running shut off the gasoline and let the motor run down. If the engine is particularly dirty, it may be advisable to protect the carburetor and pan by placing some asbestos paper at points to prevent fires from flying sparks.

Remove spark plugs from cylinders—not the valve caps. Crank the motor until the cylinder to be started upon has the piston at the top, with both valves closed.

Set the pressure on the regulator at about fifteen

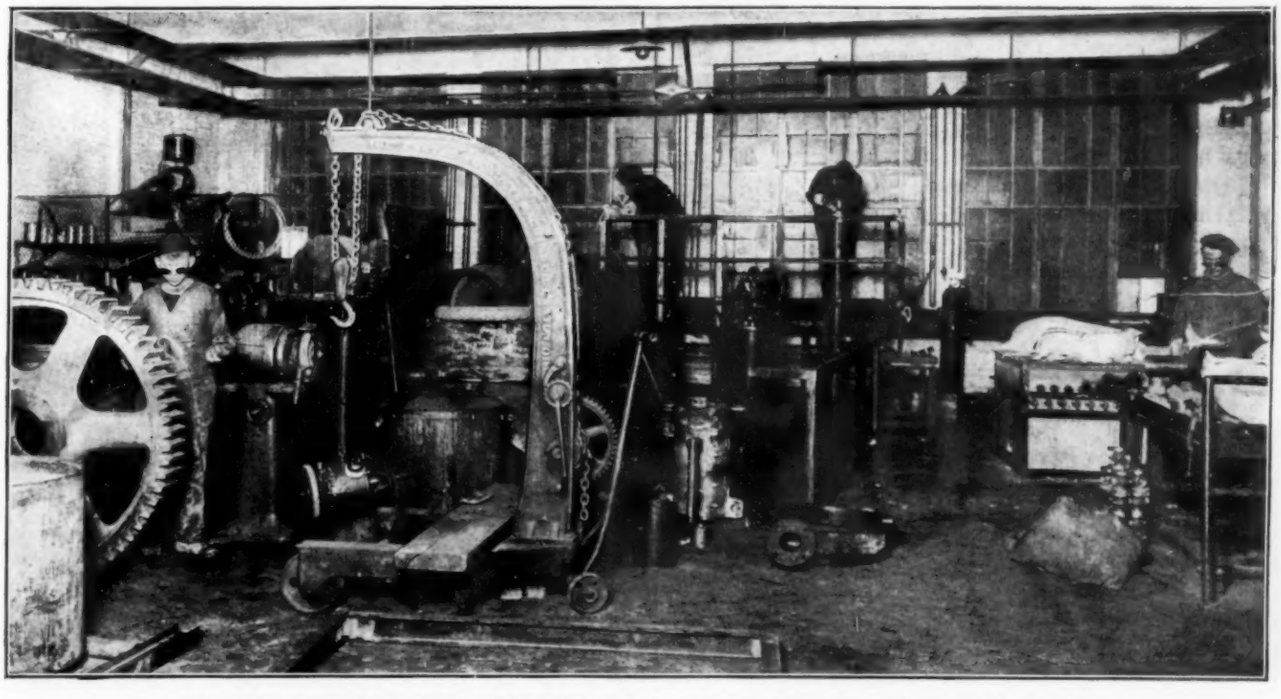


FIG. 297. INTERIOR VIEW SHOWING PORTABLE CRANE AND OTHER EQUIPMENT

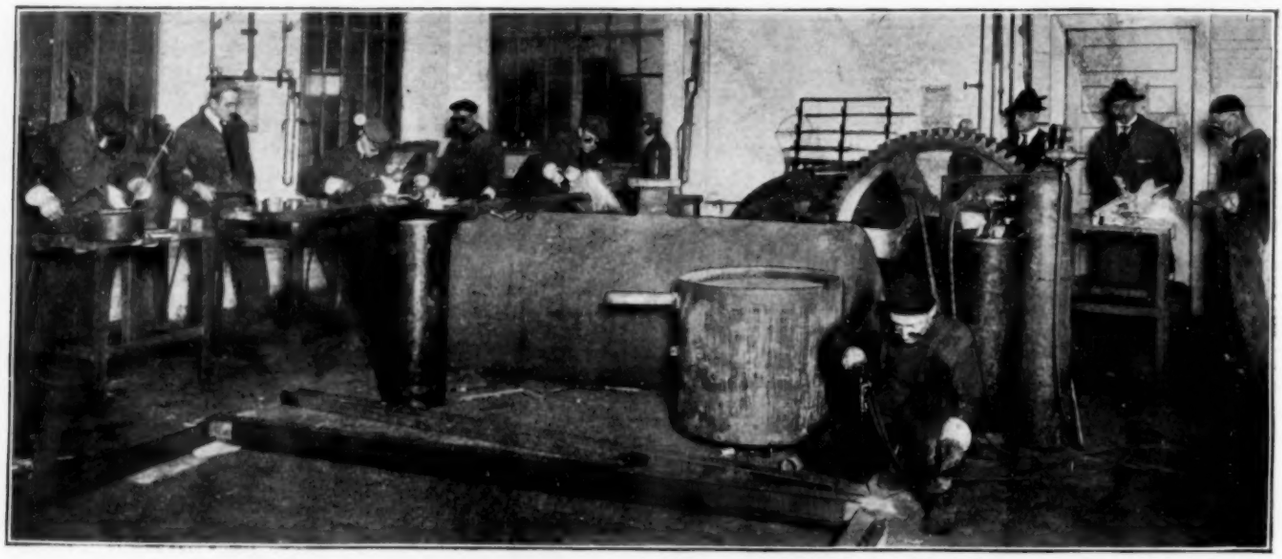


FIG. 298. VIEW SHOWING WELDING TABLES

pounds and *partially* depress the lever on the handle of the carbon burner.

Use a wax taper or drop a lighted match into the spark plug opening of cylinder, at the same time directing the copper tube of the carbon burner at that point. This ignites the carbon, and if it is not too dry, the oxygen should thereafter be sufficient to completely consume it without again lighting it. At the start, particularly if the cylinder is oily, there will be some flame as well as considerable sparks. Hold the pressure down until the flame has practically disappeared, then press down the lever all the way and move the nozzle back and forth around the walls until sparks stop.

Sometimes the cylinder is very dry and the carbon is rather difficult to burn. This can be more or less determined by the appearance of the spark plug. If it is dry, squirt about a teaspoonful of kerosene into the cylinder, spreading it over as large a surface as possible, to aid the burning.

The copper tube is flexible and may be bent as desired to reach any portion of the cylinder. Actual contact with the carbon by the tube is not necessary to consume it—carbon burns in an atmosphere of oxygen after it is ignited.

The only possible danger to the cylinder, valves or piston is a too high pressure of oxygen on an extremely

Oxygen gauge, start	1800 lbs.	=	100 cu. ft.
Oxygen gauge, finish	900 lbs.	=	50 cu. ft.
Oxygen used	900 lbs.	=	50 cu. ft.
Acetylene used—			
50 cubic feet @	2½		$1.25
Oxygen used—			
50 cubic feet @	2		1.00
PREHEATING COST			
Charcoal			
Gas, ½ hour, 2 burners @	60		.30
Kerosene			
LABOR (Preparing)—			
1 hour 30 min. @	60		.90
LABOR (Welding)—			
1 hour 30 min. @	60		.90
LABOR (Finishing and testing)—			
1 hour min. @	30		.30
RODS—			
Lbs. Steel @			
15 Lbs. Cast Iron @	10		1.50
Lbs. Bronze @			
Lbs. Copper @			
Lbs. Aluminum @			
FLUX—			
½ Cans Cast Iron @	50		.25
"			
"			
"			
"			
Total			$6.40
REMARKS			

FIG. 300. SUGGESTION FOR COST CARD

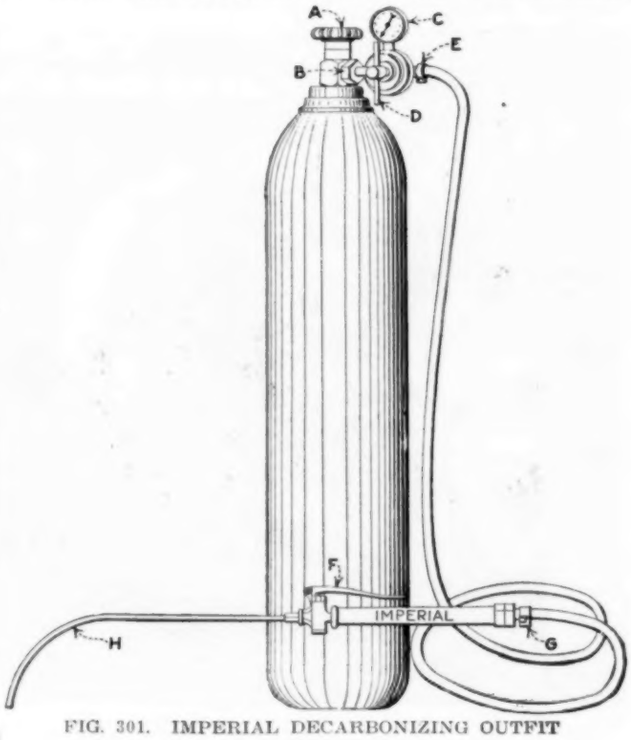


FIG. 301. IMPERIAL DECARBONIZING OUTFIT

WORKING ORDER—WELDING SHOP

JOB No. _____ DATE _____ 191_

NAME _____

ADDRESS _____

DESCRIPTION OF WORK REQUIRED _____

TIME JOB RATE $ _____ PER HOUR. GAS, MATERIAL AND EXPENSES EXTRA. INVOICE $ _____

CONTRACT PRICE $ _____ SALESMAN _____

PAY COMMISSION OF _____ % ON $ _____ AMT. OF COMMISSION $ _____

DATE COM. REPORTED _____ 191_

SHOP TRANSIT							
ARTICLE	AMOUNTS USED				TOTAL AMOUNT USED	PRICE	TOTAL COST
Charcoal							
Oil, Preheating							
Cast Iron Rods							
Oxweld Iron Wire							
Alum. Rod Wire							
Bronze							
Rivets							
Flux Kind							
Steel Rod Kind							
Asbestos							
Gloves							
Carbon, Rod Block							
Goggles							
Miscellaneous							
Board and Lodging							
R. R. Fares							
Freight or Express							
Cartage							
TOTAL COST—SHOP TRANSIT $							

REMARKS.

GAS		LABOR				
Oxygen Cu. Ft.	Acetylene Cu. Ft.	Date	Welder's No.	Hours	Rate	Total
		TOTALS				

INDIRECT CHARGE A/C FOREMAN _____ $ _____

TOTAL LABOR _____ $ _____

OVER HEAD _____ $ _____

Gas	Amt.	Price	Total	
Oxygen				$
Acetylene				$

SHOP TRANSIT _____ $ _____

BASE COST _____ $ _____

COM. TO SALESMAN _____ $ _____

PROFIT FOR COMPANY _____ $ _____

CHARGE CUSTOMER _____ $ _____

FIG. 299. COST KEEPING FORM

oily cylinder—there would be considerable heat generated in this instance. Hold the pressure down, then, until the flames have gone and sparks only are being thrown out before fully opening the lever on the handle.

When through cleaning, it is desirable to remove the valve cap and blow out any solid particles there may be present; these solid particles cannot be carbon, but may be pieces of iron, etc. The appearance of the cylinder will be considerably improved by swabbing off the top of the piston and valves with an oily rag.

Carbon burning is a very practical solution of carbon deposits—but care and horse sense must be used, though the process calls for no particular degree of skill.

Shall We Make Essentials Or Non-Essentials?

BY JOHN S. WATTS

I have read, pondered upon, and written sundry articles bearing on the underlying causes and have suggested remedies for the present unrest in the whole world, and have yet to see in any part of the world an intelligent effort by "those set in authority over U. S." to lead us out of the turmoil.

Those who take time to spend a few moments thought on the subject usually give as the reason for it the reaction from the war and the shortage of essentials due to the destruction incidental to the war. If asked for an explanation of what is meant by the reaction from the war the answer is that the war increased the wages of almost all manual workers, and they acquired more extravagant tastes, which have raised the so-called standard of living without increasing the production of the goods required to satisfy this higher standard.

If this were the whole truth, which I shall endeavor further on to prove it is not, we could expect that time would cure the evil; but on the contrary, notwithstanding periodical prophecies that the world will soon be back to normal, conditions are going steadily from bad to worse. Even as it is there seems to be no concerted effort to arrive at the just solution for the cause of the manual workers' continual demand for more and ever more.

If we had competent leadership in our communal affairs it should not be impossible to convince a set of dissatisfied workers that they are in actual fact receiving the full value of their production; or, on the other hand, to prove to a recalcitrant employer that he is not paying his employees the full value of their production.

The main, in fact the only, practical argument advanced by labor in demanding increased wages is that it must be paid a living wage, apparently regardless entirely of whether it produces an equivalent in value or not. With the requirements considered essential to a living becoming more and more extravagant daily the time is fast approaching, if it is not indeed already here, when it will be impossible to draw upon the reserves built up in the more frugal past to pay out to labor more in value than it is producing.

In my opinion, not the shortage of essentials but the wrong distribution of labor is the root of our labor unrest and the high cost of living. With the present distribution of labor we have an actual shortage for the production of essentials and an overplus for the production of non-essentials. This, which is really the crucial point, seems to be almost entirely overlooked, or neglected, and for intelligent human beings we have displayed a distinct and shameful absence of leadership in the direction of our affairs as an interdependent community. We have allowed it to come to pass that the producers of actual necessities have been coaxed away to produce non-essentials to the point where actual want is a not improbable expectation.

The very ones whom we have in our ignorance attracted to the factory from their proper work of producing food are able, because of their organization, to demand and to get from the community more than their fair share of the depleted production. This is true even to an extent where the others are unable to

get the real value of their work because there is insufficient production to supply all and the stronger take the lion's share.

This shortage of essentials due to the wrong distribution of the available labor will undoubtedly become worse as time goes on unless those in authority can be made to take some action in the matter and not leave it to chance. The point I wish to emphasize is that unless a redistribution of the available manual power is made the whole population will soon be engaged in some form or other of factory work, and agriculture, the most essential occupation of all, in fact the only one that is absolutely necessary to life, will be entirely stopped because there will be none left to undertake it. The prophecy that at the beginning of the millenium men will beat their swords into plowshares needs revision, as it would seem to be more to the purpose to beat our automobiles into plowshares.

Factories Attracting Men from Farms

For some four or five generations now factories of all kinds have been attracting by every means in their power the young men from the farms. Very, very few of them or of their children ever returned to the country. This has produced the situation we now have on our hands, when there is plenty of everything but the necessities. Doubtless Henry Ford's ideal of an automobile for every working man will be realized, but will there be at that time also a barrel of flour for every family? Or, to put it another way, can we find men enough to operate the factories necessary to supply an auto for every one, to say nothing of a gramophone, gold watch, diamonds, etc., and still leave enough men on the farms to feed and clothe us?

Supply and Demand

Probably the reply of a government to the suggestion to take up the distribution of labor would be that such matters are best left to the law of supply and demand, which will right things in time. While possibly true, the time will be, I fear, too long and conditions are likely to become disastrous before this law takes effect. In fact, I believe the only remedy we shall have if we trust to the law of supply and demand, will be that sufficient numbers will starve to death, or be killed in food riots, to improve conditions for the remainder. In any case, being supposedly intelligent creatures, it ill becomes us to leave our future at the mercy of a law which is at best an offshoot of the brutal law known as the survival of the fittest.

Obviously, if we are to continue to exist, a certain percentage of the people must do agricultural work, and it is as necessary for us as a people to see that each department of our communal activities is supplied with its proper percentage of the total population as it is for a factory manager to allot the available labor proportionately among the various departments of his plant.

The ever recurring periods of overproduction in factory work are results of the working of the law of supply and demand. Factory workers are thrown out of employment and with rare exceptions they simply loaf until the demand for their product increases again. Meanwhile they have to be supplied with food and other necessities from the available supply without returning anything for it. If the unemployed answered to the law of supply and demand by reverting to agricultural work when factory work was not in demand this law would be of some benefit, but under the present conditions it simply makes matters worse.

Moreover, the owners of factories do their best to render the aforesaid law inoperative by creating an artificial demand for their products by skillful and alluring advertising and so really selling more of their output than the people are in a position to purchase. Then in order to satisfy the stimulated demand it is necessary for them to draw still further on the already depleted ranks of country workers.

Seductive Advertising of Luxuries Helps Boost H. C. L.

This seductive advertising has a double effect on the cost of living inasmuch as it creates a desire for its products in a class whose productiveness does not create a sufficient value to enable it to afford them. When we consider the insistence and cleverness of the advertising methods used it is small wonder that they are followed by a demand for higher wages to enable the worker to purchase the luxuries advertised. These higher wages are not, as a rule, accompanied by any greater production and this gives the cost of living still another boost.

High wages offered as inducement to labor and increased demand for luxuries, due to both higher wages and clever advertising, lead to a still further increase in the quantity of labor employed in producing those luxuries, and this additional labor must be largely drawn from those previously engaged in producing necessary articles. The more people working for high wages the more the demand for luxuries and the fewer people left to produce necessities. The few will continue to become fewer until a break occurs in the vicious chain.

Women Responsible for Strikes

I am firmly impressed with the idea that if we could trace strikes back to their beginning we should find that the women were responsible for the greater part of them. If Mrs. Carpenter finds that her next door neighbor, Mrs. Bricklayer, has a better gramophone you may be sure that Mr. Carpenter will have no rest until he gets his wife one that is still one grade better, and therein lies the reason why we have the sudden and apparently unreasonable demands put forward upon which no compromise is possible. We all know that when the fair sex is determined to have a thing there is nothing to be done about it, but just get out and get it, honestly if possible, but we must get it.

Our schools do not teach the subjects which would tend to attract our children to take up the truly independent life of a farmer. The whole curriculum seems to be laid out for the benefit of the city worker. Nor is the most useful science of political economy taught. If it were we would not have the people basing their demands on the belief that money in itself has value and that there will always be an amount of commodities to be purchased equivalent in value to the money in circulation. The simple fact that the value of money depends entirely upon the available supply of goods and the relation that this supply bears to the demand seem to be almost unknown.

To sum up, unless we are to starve we must take stock of our resources in manpower and see that a sufficient proportion of this power is applied to the production of necessities before any is used for the manufacture and sale of non-essentials.

Making Some Ball-Ended Plugs

By E. A. DIXIE

The production of accurate spherical surfaces is something that is not often undertaken in the ordinary machine shop. In this article the author tells how he accomplished such work and gives in detail the how and why of the necessary tools.

A RATHER interesting job came up in connection with some work I am doing, and as no one in the shop had ever done anything of this sort before, I decided to do it myself so as to gain the experience. The results were entirely satisfactory and as the method of doing the job may be new to some, as it was to me, it may be of interest:

Six plugs $1\frac{1}{8}$ in. in diameter and 7 in. long were required to have a section of an accurate sphere 34 in. in diameter formed on one end. The body of each plug for $4\frac{1}{2}$ in. from the spherical end was ground and lapped $1\frac{1}{8}$ in. in diameter. The balance of the plug was reduced to 1 in. and knurled with a coarse knurl for a grip.

A center was permissible in the knurled end, but no center was to be left in the spherical end after finishing.

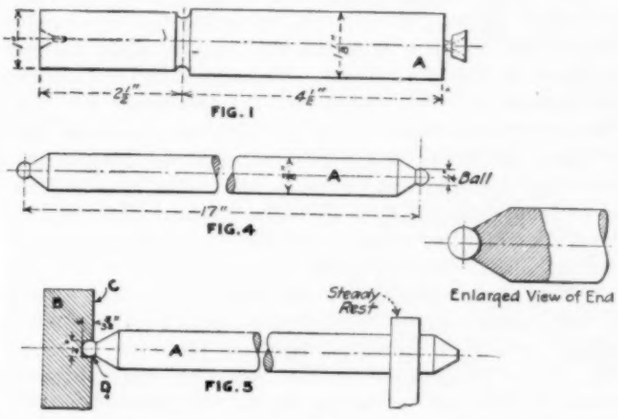


FIG. 1. THE BLANKS FOR THE SPHERICAL ENDED PLUGS
FIG. 4. CONSTRUCTION OF THE RADIUS ROD
FIG. 5. SET-UP FOR FINISHING THE RADIUS ROD TO LENGTH

For this reason the blanks were turned as shown in Fig. 1, with the end *A*, which was to be finished to the sphere, necked down so that it could be broken off after the body was ground and lapped.

Cylindrical grinding and lapping were done in the usual way, and the process is so well known that it requires no explanation. The reduced centers were then broken off and the ends roughly ground flat on a water tool grinder.

It was found that the most suitable lathe for roughing the spherical ends was a 14-in. Willard, shown in Figs. 2 and 3. The opening *B* in the steadyrest was ample for swinging the 17-in. radius rod *A* and the rest would take the Dumore grinding attachment *C* without much extra rigging.

Before starting to set up on the lathe, the radius rod *A*, Figs. 2, 3 and 4, was made. A piece of $\frac{5}{8}$-in. drill rod was cut off and the ends turned conical about 60 deg. A spherical seat was then turned in one end,

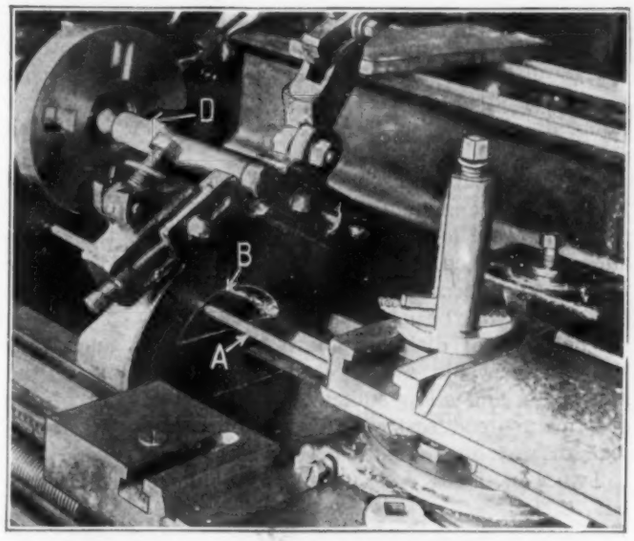


FIG. 2. THE SET-UP FOR GRINDING WITH GRINDING ATTACHMENT REMOVED

and to assure a smooth seat for the ball which was to occupy it, a $\frac{1}{4}$-in. ball was placed in it and given a sharp blow with a light hammer. A selected $\frac{1}{4}$-in. ball was then taken and tinned as was also its seat in the end of the drill rod. It was then placed in the tinned seat and clamped by pressure while sufficient heat was applied to cause the solder to flow. Care was taken that the temperature was kept below that which would draw the temper of the ball. After the rod and soldered ball were cool, a piece of steel, *B*, Fig. 5, was gripped in the chuck of the lathe and a recess turned in it $\frac{1}{4}$ in. in diameter and $\frac{5}{32}$ in. deep with a flat bottom, the front *C* was then faced true, to afford a locating surface for measuring the length of the rod. A dog was then secured near the finished end of the rod and a belt lace used to strap the job back so that the ball *D* was firmly seated in the recess in *B* which was firmly held in the chuck.

The front end of the rod was run in a steadyrest and the second ball seat, carefully worked out. Length measuring was easily carried out without removing the work from the lathe. The surface *C*, a known distance from the bottom of the recess for the ball *D*, afforded

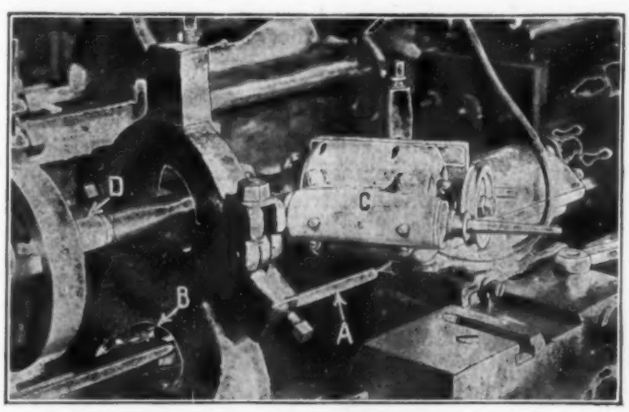


FIG. 3. SET-UP FOR GRINDING WITH GRINDING ATTACHMENT IN POSITION

a support for the base of a height gage which was improvised from a 12-in. height gage with a 12-in. vernier clamped to it. The sliding jaw of the vernier having been turned around so that the fixed jaw would not interfere with the rod *A* while measurements were being made.

The clamping on of the vernier was necessary because the radius rod was 5 in. longer than the height gage would measure. When the seat for the second ball was finished, checked up and found correct, a ball was soldered on in the same manner as the first one.

With the radius rod finished the lathe was prepared in the following manner:

Points were laid off on the headstock and the cross-slide of the lathe in such position that a line connecting them would be parallel both vertically and horizontally to the axis of the lathe spindle.

The vertical distance above the Vs was such that the rod *A* would swing clear in the opening in the steadyrest and allow sufficient lateral movement of the rod in the steadyrest opening while grinding the spherical surfaces on the ends of the plugs.

Two ¼-in. holes ⅝ in. deep were then drilled in the

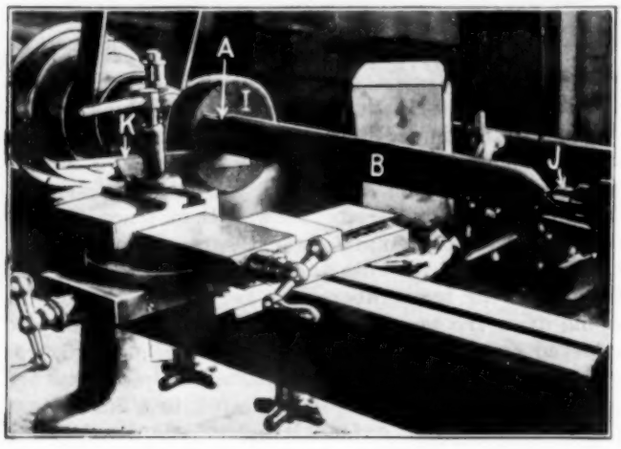


FIG. 7. THE SET-UP FOR LAPPING

headstock and cross-slide to accommodate the ball ends of the radius rod. When setting up for the grinding job, the compound rest was turned parallel with the bed, as shown in Figs. 2 and 3.

The plug *D* was driven by a dog and strapped back with a belt lace. The set-up is shown in Fig. 2, but the lathe dog and belt lace are not shown here, and the grinding attachment has not yet been placed, as with it in place it was not possible to take a good photograph from this position and show the work.

In Fig. 3 the set-up is shown in operating position with the grinding attachment in place.

While grinding the spherical faces the left hand was kept on the longitudinal feed handwheel so as to keep the carriage in contact with the ball-ended radius rod *A*. A weight was first tried but was not sufficiently sensitive. The cross-slide was fed backward and forward to move the grinding wheel across the face of the work. A diagram of the operation is given in Fig. 6. Feed to depth was obtained with the tool slide. The total time for rough grinding the 6 plugs was about 3 hours. The work came too rough from the rough-grinding operation to go direct to the lapping operation, but we have a polishing department, and by using an old 180-emery felt wheel with care the ends of the plugs were ground free-hand till the marks of the rough grinding were barely visible. The plugs were then ready for the lapping operation, and were subjected to three lappings, two roughing and one finishing. But as the methods employed in all three were the same a single description will cover them all.

A ball-ended holder *B*, Figs. 7 and 8, was prepared.

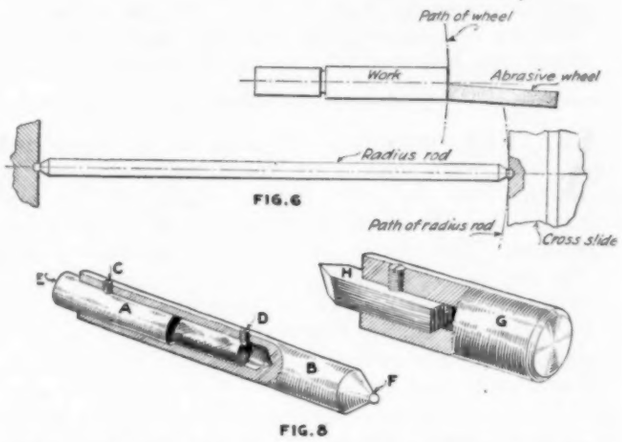


FIG. 6. PLAN VIEW DIAGRAM OF THE GRINDING OPERATION. FIG. 8. HOLDER FOR PLUGS DURING LAPPING AND TOOL USED FOR FORMING THE LAPS

In these two illustrations similar reference letters refer to similar parts. At one end the holder *B* was turned conical and a ball *F* was inserted in the same manner as those in the radius rod. The other end was bored and ground a fit for the bodies of the plugs *A*. Two setscrews were located in *B*, one at *C* to clamp the plug in place, and the conical-pointed one at *D* to aid in adjusting *A* so that the face *E* would be the required distance from the ball *F* to give the 17-in. radius so that the work could be swung on the lap and thus take advantage of all the lapping surface.

At first glance one would imagine if the lap were formed to the correct 17-in. radius, the length of the work holder would not matter, but on accurate work of this character finished in this way the work must be swung to the arc of the lap to get the desired results. Obviously, if the work and holder were shorter than

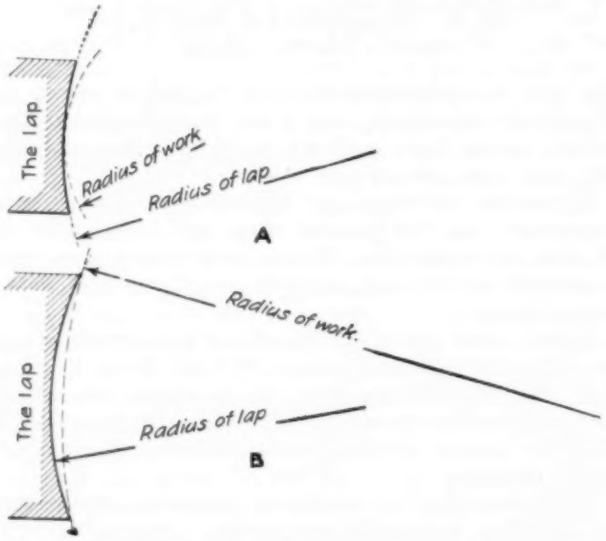


FIG. 9. DIAGRAM SHOWING EFFECT WHEN WORK AND LAP ARE TO DIFFERENT RADII

the radius to which the lap is finished, the end of the work would bear hard in the center of the lap and not at all when swung to the perimeter. If, on the other hand, the work and holder were longer than the lap radius, it would bear hard at the perimeter and not at all when at the center. Both these conditions are shown in the diagrams *A* and *B* in Fig. 9.

A toolholder *G*, Fig. 8, was also made to fit in the hole in *B*. It was held and adjusted to length by the two screws *C* and *D* in the same manner as were the plugs. At the front it carried a tool *H* made of high-speed steel. High-speed steel was used because the lapping was done on the Pratt & Whitney bench lathe shown in Fig. 7, and its speed was too high to use carbon steel for turning the cast-iron laps.

A piece of cast iron *I* was screwed to the faceplate and faced off with the slide rest.

The toolholder *G*, Fig. 8, was then set and adjusted to 17 in. in length in the holder *B*, and a special female center *J*, Fig. 7, put in the tail spindle of the lathe. A tool *K* was put in the toolpost to act as a rest as shown.

The holder *B* was placed with the ball *F* in the female center *J*. The tail spindle screw was advanced till the tool *H* cut the face of the lap *I* at the center. The cutting tool was then pulled by hand toward the front, removing the metal as it advanced; it was again moved to the center and the tail spindle again advanced and another cut taken. This was repeated till the piece *I* was concaved to nearly its perimeter. The toolholder *G* was then removed, and a plug located in the holder *B*. The lap was charged with 220 carborundum and with the plug resting on the tool *K*, the lathe was started up. The adjusting screw *D* was then screwed in, forcing the plug *A* forward against the face of the lap.

Advantages of the Method

This method of doing the work has several advantages: If the tail center is concentric with the lathe spindle axis a true hollow spherical lap may be formed as described. At the center of such a lap the speed is *theoretically* zero, and practically very slow, and, therefore lapping action is very slow at this point; however with this method I did not use the slow-moving center of the lap, but got as far as possible from it so as to take advantage of the increased speed.

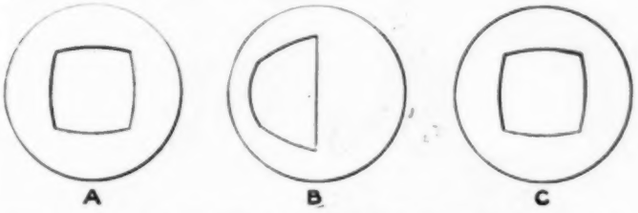


FIG. 10. REFLECTIONS OF SQUARE THROWN AT DIFFERENT ANGLES ON SPHERICAL ENDS OF PLUGS

When setting the plug the tail spindle was kept in the same position it occupied when the final cut was taken on the lap *I*. The adjusting screw *D*, Fig. 8, was slackened back so that the plug *A* could be set in *B* to such depth that it would clear the face of the lap *I* when the ball was in the female center *J*.

When working the center of a spherical lap the "scratches," if I may use such a term, are concentric on the work face and great care is required to get a high finish together with accuracy. But when working, as shown, the axis of the plug is radial from the focal point of the female sphere (of whose surface the lap surface is a part) and the position of the rest *K* whether above or below the axis of the lathe can have no influence on the accuracy of the work, its only function being to take the resistance of the lapping. Further the scratches are all approximately in one direction, *i.e.* parallel to each other, and therefore it is very little trouble to get a high finish with accuracy of shape. As the surface being lapped and the surface of the lap wear, the plug is fed forward by the screw *D*, Fig. 8, care being exercised not to apply too much pressure. When all the plugs had been lapped with 220 carborundum another lap was prepared but charged with 15-min. carborundum. The final finish lapping was done on a third lap with 60-min. carborundum which gave a very high finish.

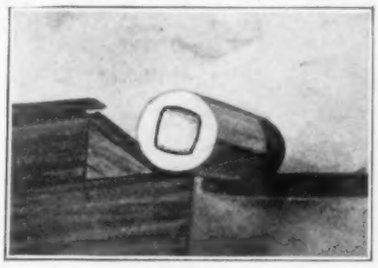


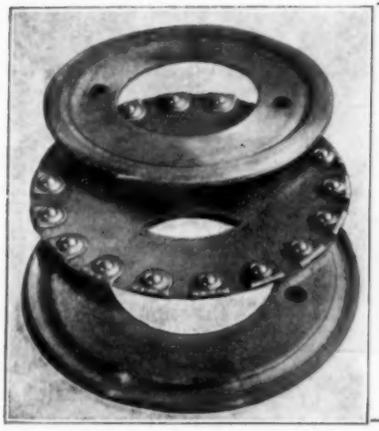
FIG. 11. REFLECTION OF SQUARE ON SPHERICAL END OF PLUG

It is a well known fact that the reflection of a taut wire is a very good test either for the straightness of a hole or for the flatness of a plain surface, so a variation of this test was applied to the spherical ends of these plugs. Four strips of black paper were gummed in a square on a pane of glass. After the gum was dry an accurate square was laid out, and with square, straight edge, and knife, the superfluous paper was cut away leaving an accurate square with sides about 18 in. long by ¾ in. wide. The glass with the square on it was then secured in one of the windows, so its reflection could be observed on the ends of the plugs and noted.

When the plug was so inclined that the reflection from the square was centered round the center of the plug, the reflection appeared as shown in Fig. 10 at *A*. It will be noted that the sides of the square bulge all around the center.

The Time Taken Was Twenty Hours

If the plug is so located with relation to the square that the reflection of one of the sides of the square passes through the center of the plug then it will appear as a straight line while the other sides are curved as shown at *B*. By rotating the plug slowly while noting the reflection, any slight variation from accuracy of the spherical end is readily detected, and the position of the error located. I had no means of *measuring* the errors thus noted but one of the plugs which was apparently corrected was taken and passed lightly *one stroke* over a flat lap, care being taken that the new lapping scratches (to avoid refraction) ran as nearly as possible in the same direction as the original ones on the spherical surface. The reflection was then observed and the flat made by the *single passage across the flat lap* was readily detected, a distinct irregularity appearing in the reflection at this point as shown at *C*, Fig. 10. Fig. 11 shows how the reflection looked when viewed at the proper angle. The entire time making the necessary tools and fixtures, and lapping the plugs, was less than twenty hours, the lapping time alone being less than half an hour for each plug.



Press Work on the Bailey Ball Thrust Bearing

By J. V. HUNTER
Western Editor, *American Machinist*

A punch-press job on light work is the subject of this article, which gives the sequence of operations on the sheet-metal retainer used in a ball bearing. Although the operations are not new, the tools used are worthy of examination.

SOME of the light automobiles are equipped with bronze washers for thrust bearings in the differentials, and after these washers have become somewhat worn the teeth of the differential gears are no longer held properly in mesh. To take the place of this washer the George D. Bailey Co., of Chicago, Ill., is manufacturing a special ball-thrust bearing. The manufacturing operations on the bearing are done almost entirely on a punch press, the method of manufacture being described in the following paragraphs. The illustration of the thrust bearing in the headpiece shows that it consists of two side bearing plates and a center retainer which carries the balls. The bearing plates are produced by simple punch-press operations, and their manufacture offers no unusual features. They are blanked and then formed with the groove or race and given a thor-

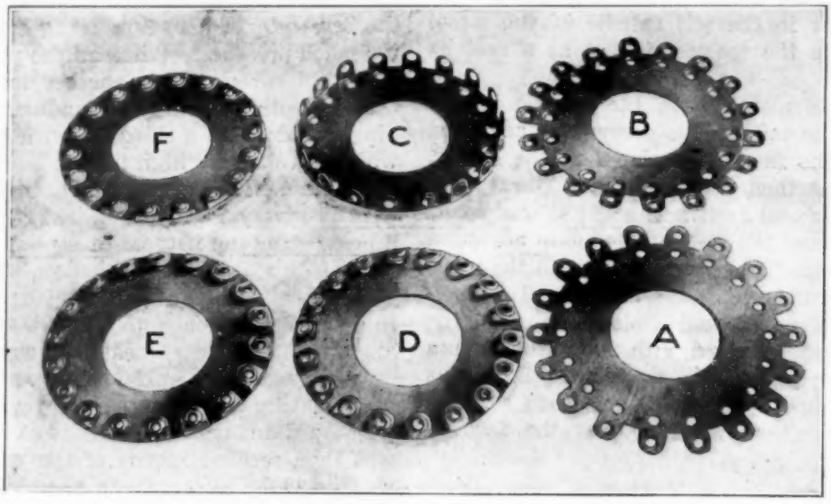


FIG. 1. STAGES OF OPERATION ON THE BALL RETAINER

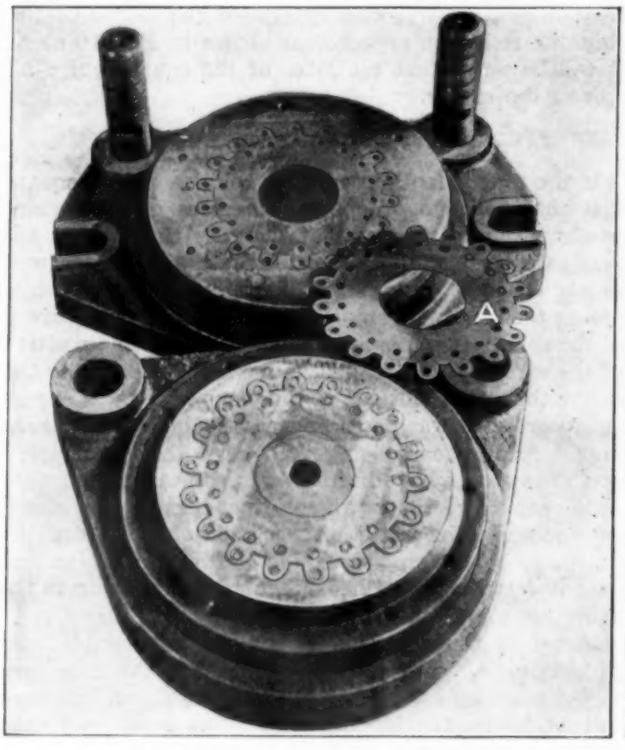


FIG. 2. COMPOUND DIES FOR BLANKING OPERATION

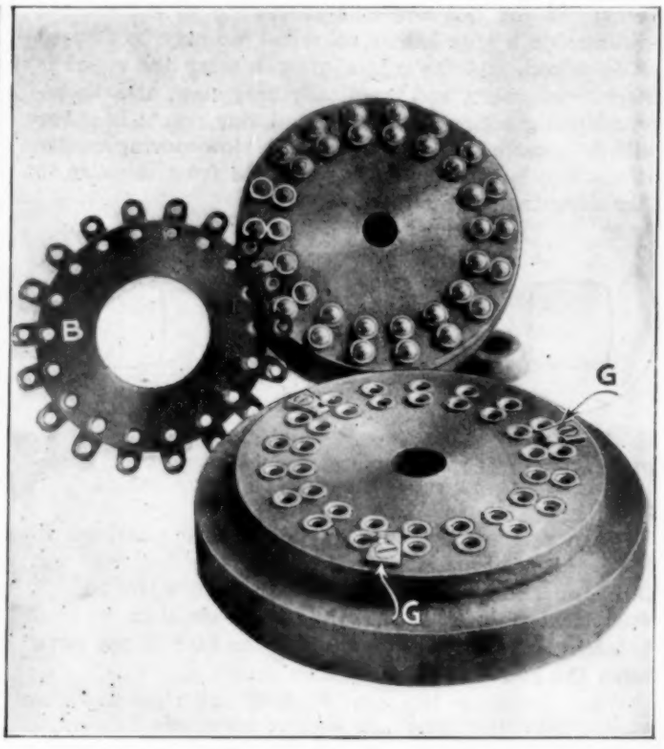


FIG. 3. PUNCH AND DIE FOR FORMING THE BALL POCKETS

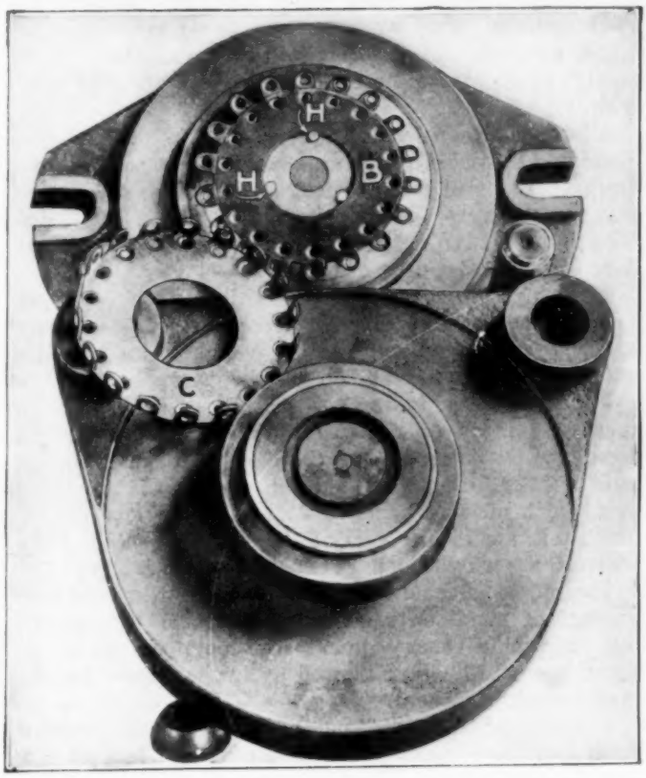


FIG. 4. TOOLS USED IN THE FIRST OPERATION OF BENDING EARS

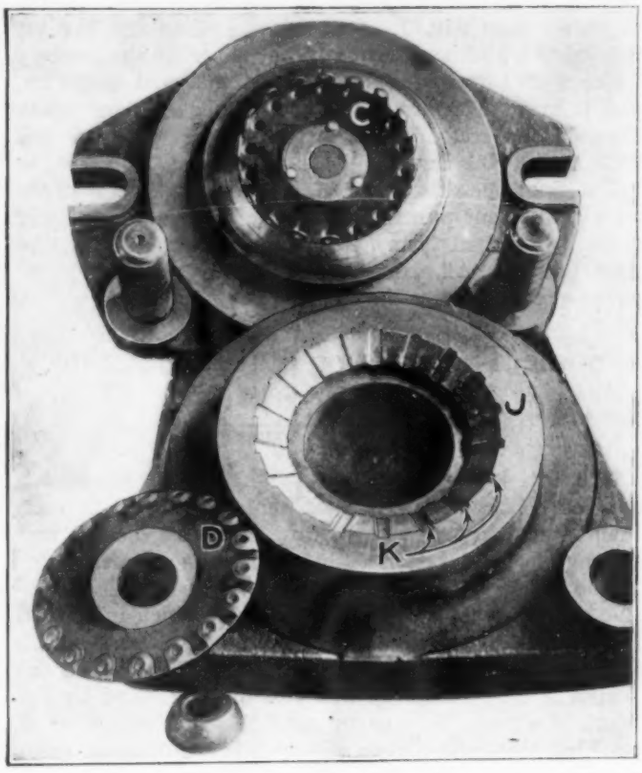


FIG. 5. TOOLS USED IN BENDING EARS DOWN READY FOR INSERTION OF BALLS

ough case-hardening and heat treatment. Then they are ground to finish the inside of the race and the back face, care being taken to grind to the proper thickness between these two surfaces.

Stamping the Ball Retainer

The blank *A*, Fig. 1, is stamped from the sheet as the first operation in the manufacture of the ball retainer; and this is followed by the drawing or countersinking operation, thus forming the concave impressions shown at *B* that are afterwards closed about the balls. The third operation stands the ears up in a vertical position, as shown at *C*, and next they are bent down as at *D* so that they stand at an angle of 30 deg. with the main body. The ears are now in a position so that the balls can be pushed under each one, as at *E*. The ears spring back into place and hold the balls until the retainer is placed under the last die and they are bent down tight, as shown at *F*.

The compound die for the blanking operation, Fig. 2, is simple in general construction and is provided with a rubber pressure pad under the stripper in the center. A punched blank is shown at *A*.

The punch and die for forming the ball impressions are shown in Fig. 3, together with a formed blank *B*. The blank is positioned relative to the forming impressions by means of the three lugs *G*, which fit between pairs of ears and both center it and hold it in the correct position over the impressions. The punch and die bodies are constructed of cast iron with steel insertions for the forming surfaces.

The punch and die, Fig. 4, serve to turn the ears up at right angles as shown at *C*. An unbent blank *B* may be seen resting on the face of the die in the position it occupies before bending, it being held in place by three round dowels *H*. A pressure plate beneath the blank retreats into the die as the punch enters, and as the punch rises again the pressure plate discharges the formed blank.

The die used for the fourth operation, Fig. 5, is the same as that used in the preceding operation, but a different punch plate *J* is employed. This plate is beveled with the requisite angle, so that its pressure

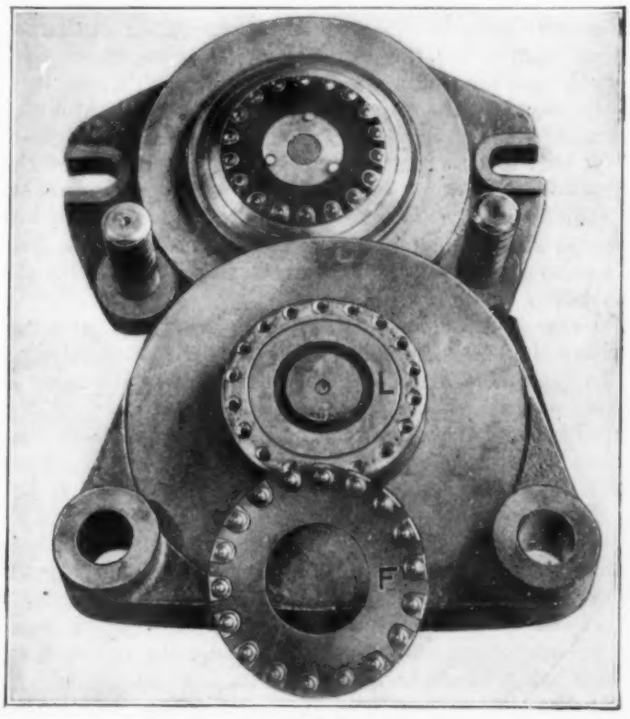


FIG. 6. TOOLS FOR COMPLETING RETAINER BY CLOSING DOWN EARS

on the blank *C* bends the ears into the position shown at *D*, see also Fig. 1. The grooves *K* in the beveled face of the punch prevent the flattening of the pockets which were formed for the balls in the second operation, and it may be mentioned here that the pressure plate likewise has recesses so that the impressions for the balls in the ring itself will not be crushed.

The final operation, Fig. 6, again uses the same die with a different punch plate *L*, which presses the ears down to the final form *F*, thus holding the balls in the retainer ring. All operations are performed on a No. 20 power press built by the E. W. Bliss Co.

Some Thoughts on Early Machine Design

By W. D. Forbes

The article on page 1 of the *American Machinist*, entitled "Examples of Early Machine Design," is more than interesting as it takes up a subject which is well worthy of consideration at this or any other time.

The first comment I would make, is upon the speculative part of the article as to the forces which influenced the early designers of machine tools. Mr. Sheldon suggests that the influence was that of Nature and the design of the drill press was possibly suggested by the trunk of a tree. Now to my mind the early designers of machine tools show very clearly what influenced them in their most creditable work. History shows beyond all doubt that the first Art that resorted to the compass, pen and drawing board was the builders trade. Kings wanted palaces to live in and monuments raised to their great deeds. Religious sentiment was also closely coupled with the kingly desires, and temples were raised. All of these demanded something grand and ornate to satisfy the vanity of man and propitiate his God.

The Gothic style of building, no doubt, was suggested by the trees of the forests, while the strong influence of the religious sects, in themselves powerful and rich, gave a most vigorous push to the Art of building. In the early days of machine-tool design when draftsmen were wanted for the work, the only place where they could be found was in an architect's office and it is little wonder, therefore, that the ecclesiastic architectural inclination is so clearly shown in all their work.

It was to be expected that when the housings of the first planers were designed the panels should show Gothic pointed terminals and that the long lathe bed should show paneling and molding that broke the surfaces so that, pleasing to the draftsman's eye, he thought that they would please others.

I saw in Providence, R. I. many years ago, a planer where the ecclesiastic idea was carried to the extreme. The back members of the housings were in the form of scaly monsters, their tails forming the feet of the machine and their eyes the bearings for the shaft that raised the cross rail. Here was the church gargoyle exactly reproduced.

Not very long ago I saw a milling machine made by the Brainard Co. and, while the general design was most modern and pleasing, the hinges of the door in the base were of the most ornate Gothic form; which showed that the old ornamental desire would crop out at times even in modern design. Again we see the Gothic idea, even today, in the lagging of steam engines.

I have often wondered if Philadelphia, the Quaker City with its plain and severe buildings, did not influence the Sellers people when they designed their first machine tools. They were the first, to my knowledge, to break away from the ornate design and the "green paint," to adopt the dignified plain form and flat gray color.

All the above refers to the speculative part of Mr. Sheldon's article concerning original machine-tool design. The real practical suggestion is that concerning the value of the old machine tools. Ornamented though they may be, the evidence is plain that their days of usefulness are not over.

The maximum capacity of a machine tool is rarely, if ever, reached. I can remember but few instances where a lathe or planer had a job which demanded its maximum. The first I can clearly remember, was a 28-in. swing lathe, taking 6 ft. between centers, used to turn a cylinder of practically these dimensions; the second, was when a planer 72 in. square in its housings with a 14-ft. bed had to finish a casting that required every inch of its capacity. Both of these jobs evoked much talk among the men of the shop and in the town where the work was done, thus showing its rarity.

The old tools could not quickly remove the maximum amount of metal on work which taxed their capacity, but they could remove quickly the metal on the pieces given them to do just as well as if the power for the larger work was there.

I know that the idea of power and rigidity of machine tools has been much talked about by builders of late machine tools, but I take the view that if excess power is never to be used it is of no value. If the excess power is to be used very rarely, it is of a little value, but as this large power must add to the first cost, and constantly to the cost of driving the machine, then it is not a good engineering job.

The early tool designers failed in bearing surfaces more than anywhere else and this made the lasting qualities of their tools less; yet it may be that the early designers did not expect the heavy work later put on the machines or they would have made greater allowances. At any rate the bearing, even though too small, seems to have stood up pretty well, particularly in the case of the lathe. In a shop under the old skating rink in Providence, R. I., I once saw an old man turning up small pulleys to be used on the grinding machines made by the Diamond Tool Co., using three old chain feed lathes. He was also turning cone pulleys such as are used on lathes and milling machines for the feed drive, and doing this latter work with a gang of three tools at a rate of speed that more modern tools could hardly have bettered. Such work does not require heavy cuts but the pulleys had to be true cylinders, and they were.

Using the old men right as well as the old tools, as illustrated in Mr. Sheldon's article, shows wisdom indeed. I know of one shop where for years the few older men who had passed the working age, were given a room in the shop where they could meet every day and read the trade papers, smoke their pipes and tell of past doings. The manager told me that the knowledge possessed by these men concerning the past products of the shop, and gained by their long service, was of the greatest value.

To recapitulate: Don't scrap your old tools or your old men too hastily. It is worthy of careful thought in designing machine tools for the future whether or not we have gone too far in providing power which is rarely required and which constitutes an extra and continuous expense.

The Evolution of the Workshop—XIV

By H. H. MANCHESTER

What the great World War did for our present-day industries was only a repetition of what occurred during the Civil War. American metal-working industries developed greatly from 1860 to 1870, and the foundations of many of our present enterprises were laid at that time. This article, the last of the series, gives data upon the American metal-working industries during the Civil War.

(Part XIII appeared in the Aug. 19 issue.)

THE necessities of the Civil War gave a great impetus to the machine shop. Many new shops sprang up, and various improved and more rapid methods were devised.

One very important machine developed for this work was the universal milling machine designed by Joseph R. Brown, and employed by Brown & Sharpe at the end of 1861, Fig. 90 showing an old print of it. This machine had a cutter which could be sharpened by emery wheels without having the temper drawn, and while still retaining its shape. The new method of sharpening made the milling machine far more practical, and led to its more general adoption.

A few years later the Journal of the Franklin Institute wrote: "This machine is adapted to the making of many tools required by gun makers and machinists, such as twist drills, mills of all shapes with straight or spiral teeth, and cutters for gears and other work. It will, moreover, cut a tapering or conical mill with right- or left-hand spiral teeth, and will take the place of the common index milling machine."

The illustrated weeklies of 1861 contained several interesting pictures with brief notes upon them which delineated the work at the different arsenals.

At the Watervliet Arsenal, West Troy, N. Y., according to Frank Leslie's, a pressure hammer was in use, superseding the old trip hammer. It was described as sending the striker down with irresistible momentum. There were also shears of "monstrous" caliber having the upper blade on a pivot, and easily cutting iron an inch in diameter. The arsenal made principally iron for gun carriages, shells, and rough tools. It depended regularly upon water power, but had a steam engine in reserve if this failed. A view of the hand-forging shop is shown in Fig. 91. An illustration, reproduced in Fig. 92, of filling canister shot at this armory shows a woman employed at the work, and one of filling cartridges, shown in Fig. 93, proves that this was done chiefly by women. The old method of casting bullets was still in use, but a new one had just been invented.

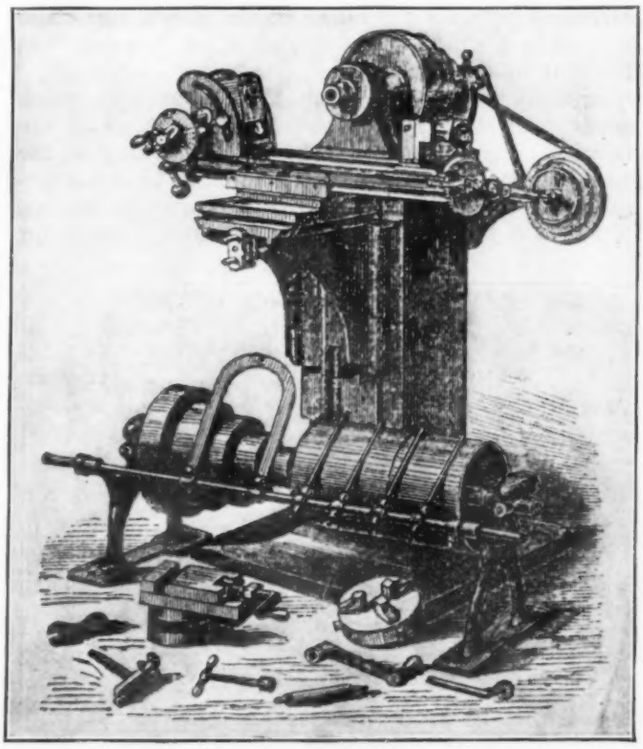


FIG. 90. THE BROWN & SHARPE UNIVERSAL MILLING MACHINE IN THE EARLY SIXTIES

FIG. 91. THE HAND-FORGING SHOP, WATERVLIET ARSENAL, 1861

The Springfield Armory, according to Harper's Weekly, 1861, was chiefly engaged in the manufacture of the famous Springfield rifle which was used by the great majority of the volunteers. This rifle was assembled from forty-seven pieces which were put together with screws and springs. Its manufacture required 396 distinct operations by different workmen. The workmen were held strictly accountable for the quality of their work. An average of one out of sixty barrels burst while being proved, but the rent usually disclosed where the weakness lay, and the barrel was charged back to the workman whose fault it was. The bayonets, which were also made in the armory, were milled and not ground as formerly, and the change was said to have been of great advantage to the health of the workmen.

Harper's Weekly gave a page of a dozen cuts illustrating the principal operations in making the barrel and bayonet; this page is shown in Fig. 94. It is noticeable that the barrel was rolled, shaped, bored, rifled, and polished by machines. The straightening, however, was still done by eye and hand.

Illustrations of the West Point Foundry which appeared in Harper's Weekly in 1861, and which are shown in Fig. 95, show the boring and rifling of the guns, and the turning of the trunnions. This foundry had been established as early as 1817 at Cold Spring, Putnam Co., N. Y. In peace times the demand for cannon had often been so slack that the foundry had been used for making steam engines and other heavy machinery. During the Civil War, Parrott guns were made there, which re-introduced the old 15th-Century method of strengthening cannon with metal hoops.

FIG. 93. WOMEN FILLING CARTRIDGE, WATERVLIET ARSENAL, 1861

In the United States arsenal at Watertown there were seventy women among the three hundred operatives. The powder was inserted in the cartridges and shells by the men, while the bullets were put in by the women.

Some of the difficulties involved in heavy iron work at the time are illustrated by the efforts required to build the Monitor. This famous ironclad was contracted for by Winslowe & Griswold, the iron masters, at their own risk if it proved a failure. The hull was built by Thomas F. Rolant, agent of the Continental Iron Works, at Greenpoint, Long Island; the engines by the Delamater Iron Works of New York; the turret

FIG. 92. FILLING CANISTER SHOT, WATERVLIET ARSENAL, 1861

by the Novelty Iron Works of the same city, while some of the plates were made by H. Abbott & Son of Baltimore.

Harper's said that at the time there was no rolling mill able to roll the plates, and that they had to be forged with a great deal of effort. It gave pictures of the forging of a bloom, Fig. 96, and of a plate, Fig. 97, for the new style of craft. There is, however, a statement that Abbott & Son rolled part of the plates which they produced. Some of the guns for the later monitors were made at the Fort Pitt Works in Pittsburgh. There the guns were cooled by water from the inside, which was thought to be a protection against flaws. Fig. 98 is of interest because it shows the methods in use at that time.

Manufactures Other Than Guns

One industry which was not entirely overshadowed by munition making was the manufacture of sewing machines. These machines were still novel, and permitted a saving of labor which was greatly to be desired at the time.

A description of the Wheeler & Wilson factory in 1863 includes several interesting details. The work was still let out on a curious contract system, although it was done in the shop. All the materials and tools were furnished by the company to so-called jobbers who produced the separate parts. What was then considered the utmost accuracy was required. To secure this there was a set of gages or duplicates provided for every

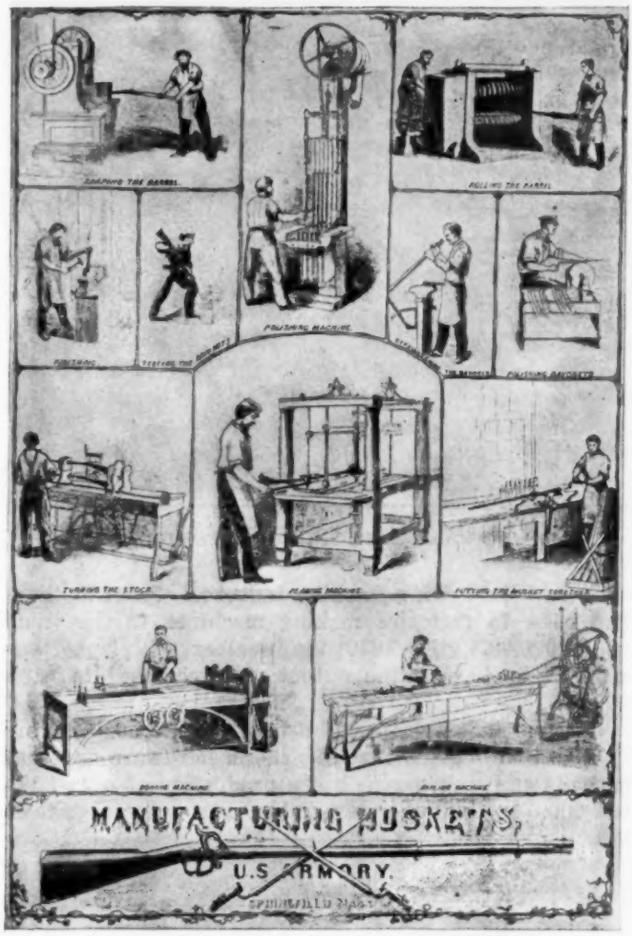


FIG. 94. MAKING THE SPRINGFIELD RIFLE, 1861

screw, spring, joint, and bar. These standards were supplied to the contractors, while originals of them were accessible only to the superintendent.

The most novel process employed seems to have been in making the rotating hook. This was first cut off about seven inches long, then heated in a furnace and placed under a draw press which had dies in either face corresponding to the shape desired. There were four separate dies required to bring it to the rough form, after which it was again softened and taken to the machinist.

At the end of the war we find the edges of armor being planed, and the plates themselves multiple drilled. There were also planing machines using a number of tools at once, as well as a machine making nuts, and another one heading bolts at a single operation. In 1866 William Sellers & Co., of Philadelphia, were employing the formed-tool system of gear cutting. J. R. Brown's micrometer caliper dates from 1867.

In 1867, according to the Journal of the Franklin Institute, "Numerous shops supplied with every facility for the construction of arms were left unemployed. Many of them very judiciously turned their attention to the production of a class of small tools for which their peculiar facilities especially fitted them, and . . . we have thus introduced into the market a new class of articles."

In various brief articles at the time, the Journal mentioned an improved toolholder by Cooper, a boiler-maker's drifting tool, cutters for the teeth of gear wheels, a vertical boring and turning machine weighing seventy tons, a die bolt-cutter, and improved screw-cutting and screw-slotting machines.

A dictionary of machinery, published at Philadelphia in 1869, gave as the principal machine tools then in use the self-acting lathe, steam hammer, and machines for planing, slotting, vertical and radial drilling, shaping, and shearing.

Data on the Metal-Working Industries in 1870

Probably the most exact information concerning conditions in the machine-shop industries at this period is to be found among the details of the census of 1870. As this was just half a century ago, it is interesting to recall what the situation was then, as a basis for realizing the tremendous contrast between that date and today.

The production of forged and rolled iron had been multiplied about four times since 1860, though the total output was still only about $128,000,000. This was produced in about four hundred plants, which gives an average of only $320,000 to a plant. These mills employed about 48,000 men, and paid wages of approximately $27,000,000, which suggests average earnings during the year of about $562 per man. There was more than five times as much steel produced as in 1860, though the total product was as yet only about $9,600,000. The manufacture of bessemer steel had already begun, and there were three plants running which produced about $1,800,000 worth.

The steam engine and the waterwheel were running neck and neck in a race for popularity. In the 250,000

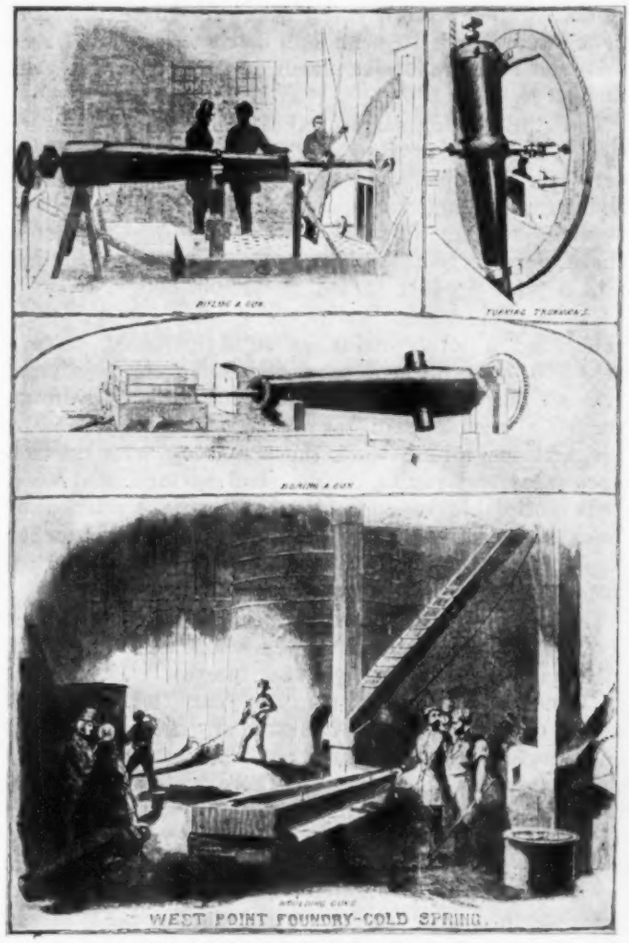


FIG. 95. A PAGE FROM HARPER'S WEEKLY, ON GUN MAKING, 1861

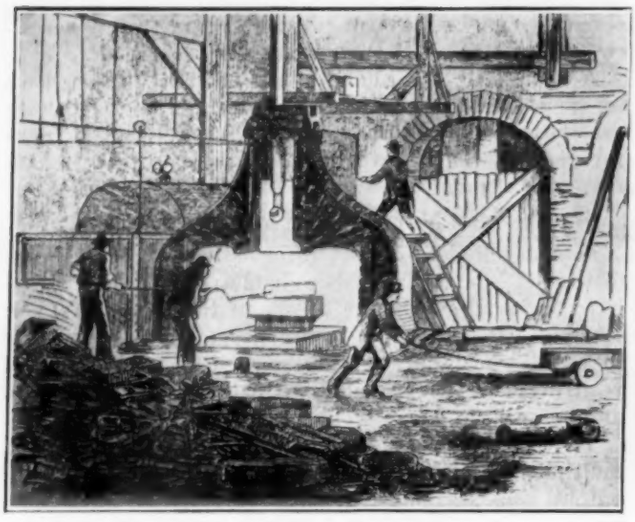


FIG. 96. FORGING A BLOOM FOR THE MONITOR, 1862

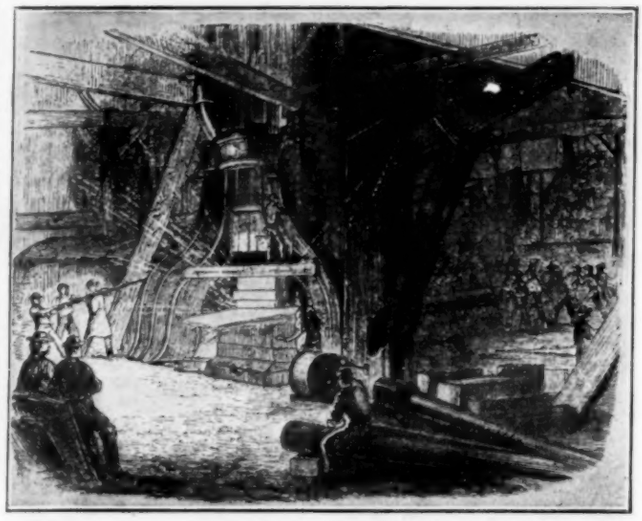


FIG. 97. FORGING A PLATE FOR THE MONITOR, 1862

plants in the country, there were about 40,000 steam engines employed, and about 51,000 waterwheels. In horsepower, however, the steam engines had already passed the waterwheel, supplying 1,215,000 hp. as against 1,130,000 from the waterwheels.

The total production of machinery in 1870 was not quite $140,000,000, as against something over $50,000,000 ten years before. In fact, a comparison of the statistics of 1870 and 1860 of both the North and the South, suggests that the machinery of the North was a decisive factor in winning the war—in that it permitted the North to send half her men to the battle field, and still produce as much or more than she ever did before.

The statistics on some of the industries which were just rising at that time are worthy of note. There were, for example, over 2,000 establishments making agricultural implements, which included the new mowers, reapers, binders, and threshing machines. There were forty-nine plants making sewing machines with a total product valued at $14,000,000.

Steam engines and boilers were made in 663 plants which had a total production of $41,576,000. There were 170 plants making cars, and doing car repairing, with an output of about $31,000,000. Other railroad repairing was done in 150 shops. The industries of the next magnitude were those making wrought-iron pipe, safes and vaults, scales, steel springs, and wire. It is noticeable in connection with the statistics of these comparatively new industries that the number of plants was surprisingly large, but that the average output was only a small percentage of that today.

The census of 1870 also includes the actual number of the machines of certain types which were produced. In some cases these are of great interest. There were 1,137 locomotives built during the year, 10,226 portable steam engines and 7,667 stationary steam engines. There were 90 caloric engines and 101 steam fire engines built during the same year. There were 6,981 lathes manufactured in the country and 178 planing machines for iron. Only one plant in the country was designated as being engaged chiefly in iron shipbuilding. In this connection it is worth noticing that only eighteen riveting machines were manufactured during the year in the whole United States.

The tendency toward consolidation was already being shown in the sewing-machine industry. In 1860 there had been 75 factories making machines to the value of $4,000,000. In 1870 the number of plants was reduced to 49, but the output was increased to $14,000,000.

Of the industries not already mentioned dealing largely with metals, that of general hardware and that of nails and spikes each had a production of over $20,000,000. In the five-to-ten-million class were edge tools

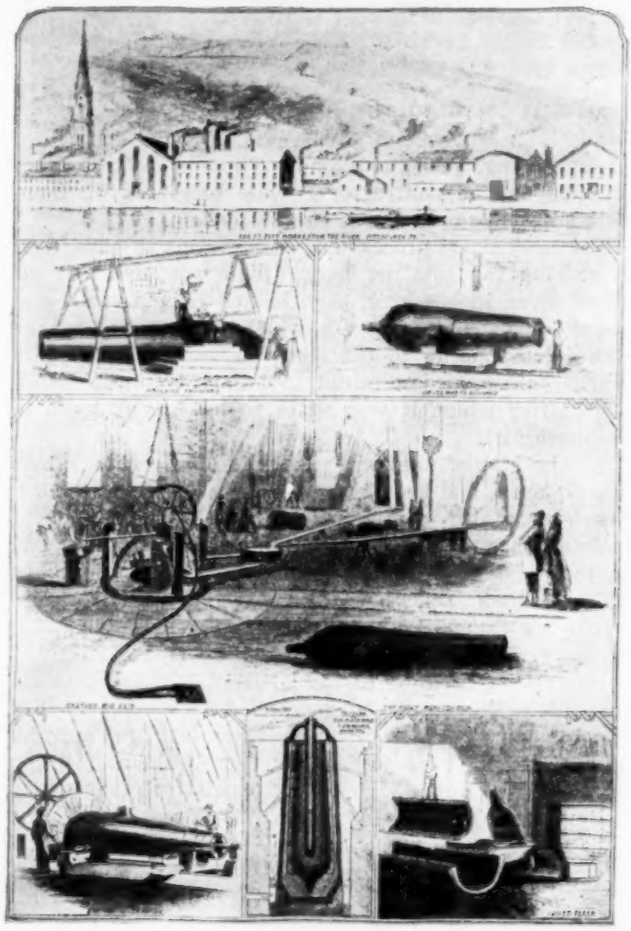


FIG. 98. MAKING A CANNON FOR THE LATER MONITORS, PITTSBURGH, 1862

and axes, firearms, bolts and nuts, cast steel, and wheel wrighting. Industries with a production of from one to five million were cutlery, files, heating apparatus, lightning rods, percussion caps, saws, shovels and spades, and steel springs. The metal industries with a production of less than a million were gunsmithing, hinges, anchors and cable chains, and needles and pins.

It will be noted that by this time a beginning had been made with most of the machines upon interchangeable manufacture and quantity production, which were to be the great features of American manufacture. The nail-cutting machines of the early Republic, Blanchard's shaping lathe for irregular forms, the milling machine, the profiling and edging machine, the turret lathe, and certain of the die-stamping machines for metals were all first developed in America, and were all directly applicable to the rapid reproduction of duplicate parts.

This brings our story up not only to a half century ago, but, what is of more importance than any mere date, to the era of the *American Machinist*, in the files of which it is possible to follow the evolution of the machine shop throughout all its subsequent phases.

"Wanted—Young Man, Fully Experienced"

BY ENTROPY

Pick up any Sunday paper, scan the "Help Wanted" columns and it seems as though the larger part of the "ads" begin by specifying a young man, and most of them demand experience. The terms are so contradictory that it seems worth while to inquire a bit into the motives which place them so prominently in these "ads."

First of all, the requirement that the man shall be young is based on one truth and one misconception. The truth is that young men are more easily adaptable to the way business is done by the advertiser. A man who has worked for years for one or many firms acquires a ripeness of experience that is really not wanted in many establishments. The man who is always ready with a line of talk about "How we used to do it in ———" is about as welcome in some places as the measles. To be sure the same firm will go outside and hire an expert to tell them the same thing, but that is different; then they pay for it and it is worth money.

The misconception that affects advertisements for young men is that they, once trained in the way of the company, will have a longer life ahead of them and will therefore return greater dividends on the investment in training. Facts happen to lean the other way. It is the young man who rises and sees visions beyond the company with whom he learns the business, and reaches out, usually successfully, and grasps opportunities where his employer cannot see any.

What is meant by "fully experienced"? It cannot be taken literally, as no man is fully experienced in anything and never can be. Some have more experience than others, and some have much more intensive experience than others.

What is usually meant by fully experienced, is a degree of experience that has taken off the raw edges and has put a man where he can go ahead without continual instruction and bolstering up. Recently an advertisement for a young man "experienced in traffic management" was answered by a lad just out of college, who had worked in a railroad office and in the freight house two or three summer vacations. He got the job, simply because he was the only one of those responding who had had any experience at all and who was willing to work for the meager salary offered, which, by the way, was considerably less than he could have obtained by going into the freight house again and juggling freight. In this case the word "experienced" in the advertisement expressed a hope rather than a requirement, or, better yet, it was a figure of speech.

There is a perfectly sound theory that each firm should get all its raw material soon after graduation from college and train it in its own way. This has been carried farther by the transportation and transmission lines than any others. In railroad work and in the telegraph and telephone lines, seniority has a real and visible value. The one most notable result is that they have a low labor turnover, so far as individual quits are concerned, but they have a high strike average; that is, the men feel that if they hold together they can make their point without losing seniority rights. Their experience is in the formative stage. They are experienced in certain parts of the work, and in due time will naturally have more experience. This plan is certainly much better than that of so many shops which simply let promotion go by chance, with the chances against the most capable men, whose foremen are bound to block their promotion because they do not want to break in other men to do the work, and where no one really knows whether he is being promoted or demoted when he is shifted from one job to another.

There is a better plan, however, and that is to provide a plainly visible line of promotion and then to promote those who deserve it without reference to seniority. This is not the easy way because it makes it necessary to tell unpleasant truths to men whose friendship is likely to be valuable to the firm at some later time. It is wise to have this proviso because it makes the heads of departments do some serious thinking into the future when they promote or demote a man. It is not so easy to push Cousin Tom ahead over some other man's shoulders when one must explain to the man over whom he is put just what the merits of the case are. Under the seniority rule it is easy to tell Tom that he will have to wait his turn, but it is equally easy for Tom to take it very easy while he is waiting for someone else to die. Moreover, the seniority system does prevent men reaching responsible jobs before they lose their elasticity and ability to adapt themselves to new conditions.

There is an old saying, "Young men for war, old men for counsel," which pretty well fits the question of age in the employment office. There are always jobs that require physical strength and quickness. There are jobs that require quick mental action, but there are also many jobs that will get on the nerves of a quick thinker, or a strong, quick-motioned man. These are the jobs for men who have lost elasticity, whether physical or mental. Some of these jobs are easy and some are difficult and important. Judicial jobs are never easily filled. The man under forty who can efface himself and his own likes and dislikes from the consideration of a problem is rare. It is only when a man can see that there is a possibility that he will not live to see the world complete its term of existence, and realizes that very possibly it may go on after he leaves it, that he is able to take a calm view of many vexing problems.

Report of the Classification and Compensation Committee to Engineering Council

IN ITS progress report to Engineering Council, presented at the meeting of June 17, 1920, by Chairman Arthur S. Tuttle, the Committee on Classification and Compensation of Engineers makes the following statements regarding the report of the Congressional Joint Commission on the Reclassification of Salaries.

"The classification of engineers proposed by the Congressional Joint Committee on Reclassification of Salaries shows that the work of this commission has been guided largely by the work of your committee, and a comparison of its recommendations with those of your committee will be shortly released for publication. It is the belief of the Committee that, to say the least, the Federal Commission's classification where it differs from that of your committee has no advantage. The compensations for the various positions proposed in the Federal report are disappointing as they do not provide anything like the increases which are believed by your committee to be essential to the end that the engineering profession may attract and retain men of proper calibre to assume responsibilities successfully.

"From the analysis it would appear that in the lower grades of Federal service in sixteen bureaus the compensations proposed by the Congressional Commission would be from 2 to 19 per cent less than those which have heretofore prevailed, while in the higher grades the increases range from 8 to 17 per cent. The proposed salaries other than those for the grade "Junior Assistant Engineer" range from 20 to 30 per cent less than those suggested by your committee."

Discussing work to be undertaken, the report states: "It is proposed to undertake a vigorous campaign for the purpose of securing recognition of the classification of various positions as recommended by the committee last year and as adopted by council on Dec. 18, 1919, and at the same time to secure a general expression of opinion on the part of engineers and heads of services as to the compensation schedule tentatively suggested by the committee."

In addition to addressing communications to the secretary of each of 123 engineering societies in the United States and Canada, "arrangements are being made to secure co-operation on the part of the lay as well as the engineering heads of all services employing engineers and of all Civil Service Commissions.

"The committee is hopeful that the plans which it has laid for continuing its work will bring to its assistance the earnest backing of engineers throughout the country in making the classification effective, and that information as to the value of engineering service and as to a wise employment policy will be obtained from such a wide variety of sources that it will be practicable to formulate definite recommendations along these lines and to set up standards which will insure respect."

Comparison of Report of the Congressional Joint Commission on Reclassification of Salaries With the December, 1919, Report of Engineering Council's Committee

The Congressional Joint Commission's report on Reclassification of Salaries was presented to Congress March 12, 1920. Its main features are as follows:

Findings

NOTE: The numbers of the paragraphs correspond to those in the report of the Congressional Joint Commission.

"As to lack of uniformity and equity in present rates:

"1. That the salary and wage rates for positions involving like duties and responsibilities and calling for the same qualifications (that is, for positions of the same class) show wide variations and marked inequalities.

"2. That the salary and wage rates for positions of the same class are different in different departments and independent establishments, the scale of pay in some departments being markedly higher than the scale for the same class of work in other departments.

"3. That these inequalities in salary and wage scales as between departments are most striking when the rates of pay in the war-expanded establishments are contrasted with those in the organizations that were not largely increased during the war.

"As the causes that have led, and unless remedied will continue to lead, to this lack of uniformity and equity:

"7. That the Government has no standard to guide it in fixing the pay of its employees and no working plan for relating the salaries appropriated to the character and importance of the work for which such salaries are to be paid.

"11. That the absence of any uniform plan or system for regulating increases in pay of employees who have gained in experience and usefulness in a given class of work and the even more serious lack of any equitable system governing promotions from lower to higher classes of positions have been very large factors in causing the disproportion in pay and work.

"As to the effect of the lack of uniformity and equity in rates of compensation of Government employees:

"12. That there is serious discontent accompanied by an excessive turnover and loss among the best trained and most efficient employees, that the morale of the personnel has been impaired, that the national service has become unattractive to a desirable type of technical employee, and that the Government has put itself in the position of wasting funds on the one hand and doing serious injustice to individuals on the other, and of failing to get that degree of efficiency in administration that a more equitable and uniform wage policy would bring about.

"As to certain conditions of employment having bearing on compensation:

"13. That seven hours constitute a normal day's work for the clerical and professional groups of employees and eight hours for the manual; and that there is no uniformity of practice in the compensation for overtime and night work.

"16. That opportunities for advancement, either in salary or rank, for those of marked efficiency do not compare favorably with the opportunities offered to persons of the same ability in the commercial world. In the opportunity for development of professional or scientific careers, the Government service has in many ways a distinct advantage, which is, however, offset to some extent by certain personal restrictions generally unknown in the academic and business world.

"18. That the Government is paying heavily in the form of employees' compensation, as well as in loss of time and efficiency, for its failure to adopt a thorough going safety program. In safe construction, safety inspection, and safety education the Government falls far short of meeting the standards set by the more progressive States, municipalities, and private employers.

"As to those policies and measures that control the Government's return in efficient personal service:

"21. That there is no systematic policy of introducing new appointees to their work nor of training them for new duties, although certain progressive governmental organizations are proving the feasibility and value of such training.

"22. That in spite of the necessity of some satisfactory method of testing efficiency as a basis for salary increases and promotions, efficiency rating systems are not in general use, and where they have been adopted are commonly regarded as of questionable value.

"23. That no uniform practice exists in the advancement of efficient employees in either salary or rank, both of which are commonly referred to as 'promotion'; that salary advancements proper are controlled by administrative officers, while true promotions are usually made as the result of non-competitive examinations; and that lack of assurance that efficient work will receive suitable reward injures the morale and reduces the efficiency of the entire service.

"24. That the Government's failure to adopt a retirement system for civilian employees has proved costly, inefficient, and destructive to the morale of the force.

"26. That there is a striking lack of any comprehensive personnel policy administrated by a central personnel agency and having in view increased efficiency through standardizing and supervising the various conditions of employment and through enlisting the cooperation of the employees."

RECOMMENDATIONS

"For immediate attainment of uniformity and equity in pay for the same character of employment:

"1. That the Congress adopt the classification of positions set forth.

"2. That the Congress adopt the schedules of compensation set forth for the respective classes of positions.

"3. That the Congress authorize the Civil Service Commission to take over the Reclassification Commission's records and keep them current, pending action on the above recommendations.

"4. That the Congress direct an existing agency (hereinafter referred to as the "Classification Agency"), logically and preferably the Civil Service Commission, to make a final allocation of individual positions to the classes set forth in the recommended plan of classification.

"For the future maintenance of uniformity and equity in pay:

"6. That permanent administration of the classification and schedules of compensation be delegated by law to an existing independent agency of the Government (to be termed hereinafter the "Classification Agency"), logically and preferably the Civil Service Commission.

"10. That estimates, appropriations, and payments for personal services be made under the title of the class and in accordance with the schedule of pay applying to the class which the Classification Agency certifies as applicable to the position in which such services are to be or have been rendered.

"11. That the pay of individual employees be regulated on a basis of efficiency and length of service in the class in which their respective positions are classified, according to the schedule of compensation applying to the class.

"For attainment of uniformity in the regulation of all factors having an indirect bearing on rates of pay and for the improvement and standardization of working conditions:

"13. That the Congress prescribe standard minimum working hours for each group of employees, together with uniform rules for the compensation of overtime work for those employees for whom the compensation schedules provide for pay at an hourly rate, and for additional compensation for all night work.

"For securing the maximum return in efficient personal service for the Government's pay-roll expenditures:

"15. That the Congress undertake a systematic examination of the functions now being exercised, the organization now in effect, and the methods of procedure in use in the several departments and independent establishments making up the Washington service, in order that unnecessary work, duplicated work, improperly allocated work, instances of poor organization, and expensive or inefficient methods of conducting business may be discovered and eliminated.

"16. That the Congress provide for a comprehensive and uniform employment policy to be administered by a central personnel agency, logically and preferably the Civil Service Commission, and to include the standardization of rates of compensation and working conditions and the selection, development, and retention of an efficient personnel; and an advisory council be established to advise the Civil Service Commission on matters coming under the jurisdiction of the latter, and to arrange for the formation of personnel committees in the various departments."

Note: Advisory Council is to be composed of twelve members, six to be appointed by the President from among employees of the administrative staff, and two each to be elected by and from employees in the manual, clerical and professional groups.

"17. (a) That all positions hereafter be filled by the appointment of those best fitted to perform the duties as determined by the central personnel agency through the most effective methods of test and investigation; and (b) that no permanent appointment to the service be made except on certificate by the central personnel agency that the employee has satisfactorily passed his probationary period.

"18. That the central personnel agency be empowered to undertake, in co-operation with the departments, measures for the training of employees for increased usefulness in the service.

"19. That the central personnel agency be authorized and directed, after consultation with the heads of departments, to arrange for the installation of efficiency rating systems in the various Government establishments; and that the appropriate administrative officers be required to rate all employees under their direction in accordance with these systems and under such rules and regulations as the central personnel agency may prescribe.

"20. That hereafter employees be increased in pay not oftener than once a year and only within the limits of the range set for their class of positions and on the basis of ascertained efficiency of the required standard, to be set by the central personnel agency; and that failure to maintain such standard after advancement to a given rate shall subject the employee to reduction to a lower salary rate in the same class.

"21. That when vacancies in the higher classes are not filled by transfer or reinstatement they be filled by promotion of properly qualified employees as determined by competitive civil-service examination; and that open competitive examinations for the filling of such vacancies be held only when three such eligibles can not be secured from those already in the service.

"22. That employees who fail to attain a fair standard of efficiency as prescribed by the central personnel agency be removed from the service, after suitable opportunity for appeal to the personnel agency.

"23. That employees who, by reason of their age or disability resulting from their service, are unable to render service of a fair standard of efficiency be retired under an actuarially sound pension plan."

GENERAL CLASSIFICATION

Regarding the Engineering Service, the commission makes provision for twenty-three branches with an average of seven grades in each branch. The branches are as follows:

Aeronautical Engineering	Landscape Architecture
Automotive Engineering	Marine Engineering
Cadastral Engineering	Materials Engineering
Cartographic Engineering	Mechanical Engineering
Ceramic Engineering	Mining Engineering
Civil Engineering	Nautical Engineering
Electrical Engineering	Naval Architecture
Forestry	Ordnance Engineering
Highway Engineering	Petroleum Engineering
Hydraulic Engineering	Radio Engineering
Hydrographic and Geodetic Engineering	Structural Engineering
	Topographic Engineering

There is a close parallel between the classification recommended by this commission and that recommended by Engineering Council. The difference in title is shown in the following table:

Grade	Engineering Council	Congressional Joint Commission
1	Chief Engineer	Senior Engineer Commissioner Director Chief Engineer Chief, Superintendent, etc.
2	Engineer	Engineer
3	Senior Assistant Engineer	Associate Engineer
4	Assistant Engineer	Assistant Engineer
5	Junior Assistant Engineer	Junior Engineer
6	Senior Aid, Office Senior Aid, Field	
7	Aid, Office Aid, Field	Draftsman Aid
8	Junior Aid, Office Junior Aid, Field	Copyist Draftsman Junior Engineering Aid

Requirements in Parallel

Using the Civil Engineering branch as typical, requirements for each grade in the two classifications line up as follows:

PROFESSIONAL SERVICE

GRADE 1

Engineering Council

Chief Engineer

Duties.—To act in chief administrative charge of a technical organization, or of a main division thereof; to determine the general policies of the organization under the limitations imposed by law, regulation, or other fixed requirement: to have final responsibility for the preparation of reports, cost estimates, designs, and specifications and for the construction, maintenance, or operation of engineering works or projects; to have full charge of the collection and presentation of data for the conduct of valuation proceedings; to conduct or direct the most comprehensive lines of engineering research.

Qualifications. — Training and experience of a character to give substantial evidence of engineering knowledge and ability or of executive capacity of highest order along lines of work similar to those involved in the position to be occupied and of at least twelve years' duration, of which at least four years shall have been spent in duties of Engineer, or their equivalent, and at least five years in responsible charge of important work or projects. Fundamental training equivalent to that represented by professional degree granted upon the completion of a standard course of engineering instruction in an educational institution of recognized standing or, in absence of such degree, at least four years of additional experience. The completion of each full year of such standard course shall be considered the equivalent of one year of such additional experience.

Congressional Joint Commission

A. Senior Civil Engineer

Duties.—To perform one or more of the following functions: (1) to have administrative charge of a civil engineering organization or of a main division thereof, and to determine or execute general policies under the limitations imposed by law, regulations or other fixed requirements; (2) to be responsible for reports, estimates, designs, specifications, and data or for the construction, maintenance, and operation of large civil engineering works or projects; (3) to have full charge of the collection and presentation of data for, and the conduct of valuation proceedings; (4) to direct or to perform the most comprehensive research in civil engineering; (5) to act as consulting specialist on important civil engineering projects, policies, or valuation; and to perform other related work.

Qualifications. — Training equivalent to that represented by graduation with a degree from an institution of recognized standing, with major work in engineering, preferably in civil engineering; and not less than 12 years' general engineering experience, of which at least 8 years shall have been in the direction or performance of important projects in civil engineering work of a character to give substantial evidence of engineering knowledge and ability, or executive capacity of the highest order.

B. Commissioner of Lighthouses

Duties.—Under general direction of the Secretary of Commerce, to serve as the executive head of the Lighthouse Service; to oversee the construction, maintenance, repair, illumination, inspection and superintendence, of lighthouse depots, lighthouses, light vessels, lighthouse tenders, fog signals, submarine signals, beacons, buoys, daymarks, and other aids to navigation on the sea and lake coasts of the U. S. and on the rivers of the U. S. so far as specifically authorized by law, and on the coasts of all other territory under the jurisdiction of the U. S. with the exception of the Philippine Islands and the Canal Zone; and to perform other related work.

Qualifications. — Training equivalent to that represented by graduation, with a degree, from an institution of recognized standing with major work in civil engineering or other technical course; extended professional experience in handling lighthouse problems, of which at least eight years shall have been of a character to give substantial evidence of knowledge and ability and of executive capacity of the highest order.

GRADE 2

Engineer

Duties.—Under general administrative direction and within the limits of the general policies of the organization, to have responsible charge of and to initiate and determine policies for a major subdivision of an organization; to prepare for final executive action reports, cost estimates, designs, specifications, and valuation studies and data, to have immediate charge of the construction, maintenance, or operation of engineering works or projects of major importance; to conduct or direct major lines of engineering research; or to fur-

Civil Engineer

Duties.—To perform one or more of the following functions under general direction: (1) to have responsible charge of, and to initiate and determine policies for a major sub-division of a civil engineering organization; (2) to prepare for final executive action, reports, estimates, designs, specifications, and valuation studies and data; (3) to have charge of the construction, inspection, maintenance, and operation of municipal or other civil engineering works of major importance; (4) to conduct or to direct major lines of civil engineering research;

nish for executive action expert or critical advice on engineering works, projects or policies.

Qualifications.—Active professional practice or executive charge of work for at least eight years, of a character to demonstrate a high degree of initiative and of ability in the administration, design, or construction of engineering work or projects of major importance, of which at least three years shall have been spent in duties of Senior Assistant Engineer or their equivalent, and at least three years in responsible charge of work. Fundamental training equivalent to that represented by professional degree granted upon the completion of a standard course of engineering instruction in an educational institution of recognized standing or, in absence of such degree, at least four years of additional experience. The completion of each full year of such standard course shall be considered the equivalent of one year of such additional experience.

GRADE 3

Senior Assistant Engineer

Duties.—Under general administrative and technical direction, to be in responsible charge of an intermediate division of an organization; to exercise independent engineering judgment and assume responsibility in studies and computations necessary for the preparation of reports, cost estimates, designs, specifications, or valuations; to have immediate charge of the construction, maintenance or operation of important engineering works or projects; to conduct or direct important lines of engineering research.

Qualifications.—Active professional practice or executive charge of work for at least five years, of which at least three years shall have been spent in duties of Assistant Engineer, or their equivalent, with at least one year in responsible charge of work. Fundamental training equivalent to that represented by professional degree granted upon the completion of a standard course of engineering instruction in an educational institution of recognized standing or, in absense of such degree, at least four years of additional experience. The completion of each full year of such standard course shall be considered the equivalent of one year of such additional experience.

Associate Civil Engineer

Duties.—To perform one or more of the following functions under general administrative and technical direction: (1) to be in responsible charge of an intermediate subdivision of a civil engineering organization; (2) to exercise independent engineering judgment and assume responsibilities in studies and computations necessary for the preparation of reports, estimates, designs, or valuations; (3) to have immediate charge of the construction, maintenance, or operation of important civil engineering works or projects; (4) to conduct or direct important lines of civil engineering research; and to perform other related work. Examples: Having immediate charge of the construction of water mains, sewers, streets, and other municipal work; testing engineering materials; making cost studies; supervising surveys of areas and acquisitioning of lands; laying out of railroad terminals, yards and storage bases; estimating and expediting construction work and design.

Qualifications. — Training equivalent to that represented by graduation with a degree from an institution of recognized standing, with major work in engineering, preferably in civil engineering; not less than 5 years' general engineering experience of which at least one year shall have been in the direction or performance of important civil engineering work; and supervisory or administrative ability, or a high degree of technical skill.

GRADE 4

Assistant Engineer

Duties.—Under specific administrative and technical direction, to be responsible for the conduct of the work of a minor subdivision of an organization; to collect and compile data for specific items of engineering studies; to take immediate charge of field survey projects and of the design and construction of minor engineering work; to lay out and develop work from specifications and to supervise the work of a drafting or computing force; or to conduct specific tests or investigations of apparatus, material or processes.

Qualifications.—Experience for at least two years in duties of Junior Assistant Engineer or their equivalent. Fundamental training equivalent to that represented by professional degree granted upon the completion of a standard course of engineering instruction in an educational institution of recognized standing, or, in absence of such degree, at least four years of additional experience. The completion of each full year of such standard course shall be considered the equivalent of one year of such additional experience.

Assistant Civil Engineer

Duties.—Under specific administrative and technical direction, to be responsible for the conduct of the work of a minor subdivision of civil engineering organization; to collect and compile data for specific items of civil engineering studies; to take immediate charge of field survey projects in, or of the design, inspection and construction of minor civil engineering work; to lay out and develop work from specifications and to supervise the work of a drafting or computing force; to conduct specific tects or investigations of apparatus, material, or processes; and to perform related work as required.

Example: Directing field parties on construction, valuation, or surveys; superintending and inspecting construction work; performing the work of an office engineer; assisting the superintendent of an aqueduct or important water-supply structure; testing materials, as steel or cement; preparing technical material for publication; investigating waterproofing of structures; compiling statistical data; compiling and analyzing costs of railroad materials and construction.

Qualifications. — Training equivalent to that represented by graduation with a degree from an institution of recognized standing, with major work in engineering, preferably in civil engineering; not less than two years' experience in civil engineering work in field or office; proven technical knowledge and proficiency.

GRADE 5

Junior Assistant Engineer

Duties.—Under immediate supervision, to perform work involving the use of surveying, measuring, and drafting instruments; to take charge of parties on survey or construction work; to design details from sketches or specifications; to compute and compile data for reports or records; to inspect or investi-

Junior Civil Engineer

Duties.—Under immediate supervision, to perform routine surveying, computing drafting, and inspecting, on survey, construction, or valuation work; and to perform related work as required.

Example: Surveying with transit or level; using measuring devices for stream-gauging; inspecting struc-

gate minor details of engineering work; or to perform routine tests of apparatus, material or processes.

Qualifications.—No experience required other than that involved in securing a professional degree upon the completion of a standard course of engineering instruction in an educational institution of recognized standing; but in absence of such degree, a high school education or its equivalent is required and at least four years' experience in the use of surveying, measuring or drafting instruments, or the computation and compilation of engineering data, together with evidence of a knowledge of the fundamentals of engineering science sufficient, with further experience, to qualify for the higher professional grades. The completion of each full year of such standard course of engineering instruction shall be considered as the equivalent of one year of experience.

SUB PROFESSIONAL SERVICE

GRADE 6

Senior Aid, Office

Duties.—To supervise the plotting of notes and maps, and to direct the work of a drafting or computing squad.

Qualifications.—Experience for at least five years in tracing, lettering, drafting and computing, of which at least three years shall have been spent in the duties of draftsman. Education equivalent to graduation from high school. The completion of each full year of a standard course of engineering instruction in an educational institution of recognized standing shall be considered as the equivalent of the experience otherwise required, with the provision, however, that at least one year shall have been spent in the duties of draftsman.

Senior Aid, Field

Duties.—To direct work of field party on surveys or construction; to keep survey notes and engineering records; to supervise construction or repair work; to direct the work of computing surveys and estimates; to direct the work of making minor engineering computations.

Qualifications.—Experience for at least five years in the use and care of surveying instruments, of which at least three years shall have been spent in the duties of instrument man. Education equivalent to graduation from high school. The completion of each full year of a standard course of engineering instruction in an educational institution of recognized standing shall be considered as the equivalent of the experience otherwise required, with the provision, however, that at least one year shall have been spent in the duties of instrumentman.

tures during construction and after completion; assisting in laboratory tests of structural materials; preparing charts for statistical and engineering data; laying down lines for building foundations; drawing and tracing plans; making plane table surveys; developing and drawing details of maps and charts; lettering; giving lines and grades of highway construction; keeping cost data; serving as boat officers or as assistant in hydrographic, geodetic, and astronomic parties.

Qualifications. — Training equivalent to that represented by graduation with a degree from an institution of recognized standing, with major work in engineering, preferably in civil engineering.

No corresponding grade.

GRADE 7

Aid, Office

Duties.—To prepare general working drawings where design is furnished; to plot notes and prepare maps; to design simple structures; to make computations and compile data for reports and records; to check plans, surveys, and other engineering data.

Qualifications.— Experience for at least two years in tracing, lettering, drafting, and computing. Education equivalent to graduation from high school and familiarity with the use of the slide rule, and of logarithmic and other simple mathematical tables. The completion of each full year of a standard course of engineering instruction in an educational institution of recognized standing shall be considered as the equivalent of the experience otherwise required.

Aid, Field

Duties.—To run surveying instruments and to adjust and care for same; to compute surveys and estimates; to make minor engineering computations; to inspect incidentally construction or repair work.

Qualifications.— Experience for at least two years in the duties of rodman. Education equivalent to graduation from high school and familiarity with the construction, operation, and care of surveying instruments. The completion of each full year of a standard course of engineering instruction in an educational institution of recognized standing shall be considered as the equivalent of the experience otherwise required.

Civil Engineering Draftsman

Duties.—To perform, under immediate supervision routine drafting work in connection with the preparation of plans for civil engineering projects; and to perform related work as required.

Examples: Making tracings from original drawings; making drawings of minor importance; filing and indexing drawings, lettering, computing and revising.

Qualifications. — Training equivalent to that represented by graduation from high school; not less than two years' experience in engineering drafting work; and ability to letter and to make simple calculations.

Civil Engineering Aid

Duties.—To perform, under immediate supervision minor technical work in any branch of civil engineering; and to perform related work as required.

Example: Making measurements and estimates in the field; acting as recorder or computer in laboratory, field, or office; operating and caring for surveying instruments; computing data for reports of records; plotting notes and maps; preparing working drawings where design is furnished.

Qualifications. — Training equivalent to that represented by graduation from high school; not less than two years' experience in engineering work; familiarity with the use of the slide rule; and ability to do lettering and drafting, and to make simple engineering computations.

GRADE 8

Junior Aid, Office

Duties.—To trace and letter maps and plans; to make simple drawings from sketches and data; to make minor calculations.

Qualifications. — Education equivalent to graduation from high school.

Copyist Draftsman

Duties.—Under immediate supervision, to make tracings from original drawings, prepared by others; and to perform miscellaneous routine work in a drafting room.

Example: Making simple tracings, copying data; filing

and indexing under supervision; lettering; making simple drawings and diagrams; making hand corrections on printed chart.

Qualifications. — Training equivalent to that represented by graduation from high school; knowledge of the use of drawing instruments, and ability to use them neatly.

Junior Aid, Field

Duties. — To run tape or leveling rod; to perform other miscellaneous subordinate duties in survey party in field or office, as directed.

Qualifications. — Education equivalent to graduation from high school.

Junior Engineering Aid

Duties.—Under immediate supervision, to perform miscellaneous subordinate work in the laboratory, office or field, in any branch of engineering.

Examples: Setting up apparatus; making simple engineering computations compiling field data or laboratory notes; filing and indexing maps, plans, and notebooks; preparing samples, caring for instruments in the field or laboratory; working as rodman, chainman, or tracer, making blueprints.

Qualifications.—Common school education; good health.

Exceptions to General Classification

One glaring inconsistency in titles is found in the Automotive Engineering branch. Instead of the standard titles as proposed for the other branches, the titles proposed in this branch for grades 7, 5, 4, 3, 2, and 1 are respectively "Automotive Tracer," "Automotive Draftsman," "Automotive Designer," "Senior Automotive Designer," "Automotive Engineer," and "Senior Automotive Engineer."

In fifteen of the twenty-three branches, senior engineer is the only title in grade 1. The exceptions in the other branches are as follows:

Cartographic Engineering	No title of "Senior Engineer" provided. Promotion is from "Cartographic Engineer" to "International Canadian Boundary Commissioner."
Civil Engineering	Promotion is from "Senior C. E." to "Commissioner of Lighthouses;" "Chief Valuation Engineer," I. C. C.; "Director and Chief Engineer Reclamation Service;" or "Supervisor of Land Appraisals," I. C. C.
Forestry Service	Promotion from "Senior Forester" to "Chief, Forest Service."
Highway Engineering	Promotion from "Senior Highway Engineer" to "Chief, Bureau of Public Roads."
Hydographic and Geodetic Survey	Promotion from "Senior Hydrographic and Geodetic Engineer," to "Supt., Coast and Geodetic Survey."
Marine Engineering	Promotion from "Senior Marine Engineer" to "Supervising Inspector General, Steamboat Inspection Service," or "Commissioner of Lighthouses."
Mining Engineer	Promotion from "Senior Mining Engineer," to "Director, Bureau of Mines."
Nautical Engineering	Highest grade, "Nautical Engineer."

PROMOTION

The Congressional Commission's Report indicates that the principle line of promotion to the special positions listed above, is from the "Senior Engineer" class. The qualifications for these positions, however, are not of such high standard as those of "Senior Engineer" because all that is

COMPARISON OF CLASSIFICATION AND COMPENSATION OF ENGINEERS AS SUGGESTED BY ENGINEERING COUNCIL COMMITTEE AND BY CONGRESSIONAL JOINT COMMISSION; AND OF AVERAGE SALARY PER ANNUM AS SUGGESTED BY CONGRESSIONAL JOINT COMMISSION AND PRESENT AVERAGE SALARY OF EMPLOYEES IN SIXTEEN ENGINEERING BUREAUS IN CIVIL ESTABLISHMENTS OF THE FEDERAL SERVICE

Engineering Council							Congressional Joint Commission							
Grade	Title	Educational Equivalent	Minimum Experience in Years	Minimum	Maximum	Estimated Average	Title	Educational Equivalent	Minimum Experience in Years	Minimum	Maximum	Estimated Average	Present Average Yearly Salary (Note)	Average per cent Increase or Decrease (Note)
				Annual Salary Range						Annual Salary Range				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
8	*a.* Junior aid, office *b.* Junior, aid, field	High school	0	1,080	1,560	1,240	*a.* Copyist draftsman *b.* Junior engineering aid	High school Common school	0	840	1,260	980	1,215	—19
7	*a.* Aid, office *b.* Aid, field	High school	2	1,680	2,400	1,920	*a.* Draftsman *b.* Aid	High school	2	1,200	1,800	1,400	1,533	— 9
6	*a.* Senior aid, office *b.* Senior aid, field	High school	5	2,520	3,240	2,760	No corresponding grade							
5	Junior assistant engineer	Degree	0	1,620	2,580	1,940	Junior engineer	Degree	0	1,800	2,160	1,920	1,959	— 2
4	Assistant engineer	Degree	2	2,700	4,140	3,180	Assistant engineer	Degree	2	2,400	3,000	2,600	2,402	+ 8
3	Senior assistant engineer	Degree	5 1*	4,320	5,760	4,800	Associate engineer	Degree	5 1*	3,240	3,840	3,440	3,128	+13
2	Engineer	Degree	8 3*	5,940	....	.....	Engineer	Degree	8 4*	4,140	5,040	4,440	3,801	+17
1	Chief engineer	Degree	12 5*	8,100	....	.....	*a.* Senior engineer *b.* Commissioner, director chief engineer, chief, superintendent, etc.		12 8* 8 —*	.....	.....	.....	5,867	

NOTES—Columns 4 and 10. * Years in responsible charge of work.

Columns 7 and 13. Estimated average salary is the minimum, plus ⅓ the difference between the minimum and the maximum. This relation was found to hold approximately for positions in the Federal Service and was assumed in the studies conducted in connection with the salary schedules of the Reclassification Commission.

Column 14. Present average yearly salary, including bonus, of employees in 16 bureaus in civil establishments of the Federal Government. The bonus is $240 for salaries of $2,500 and under; for salaries above $2,500, it is the amount, if any, necessary to make a total of $2,740.

Column 15. Average percentage increase (+) or decrease (—) in pay per employee under schedule proposed by Congressional Joint Commission over present schedule, if distribution of employees within each grade remains unchanged. The estimated increase in the salary roll, which would be caused by putting the Commission's recommendations for all branches of the Civil Service into effect is, as estimated by the Commission, 8 to 10%, probably 8.5%.

required, in addition to educational qualifications is "extended professional experience" in the special branch of work, "of which at least 8 years shall have been of a character to give substantial evidence of knowledge and ability and of executive capacity of the highest order." For a "Senior Engineer," the corresponding qualifications are "not less than 12 years general engineering experience, of which at least 8 years shall have been in the direction or performance of important projects in—engineering work of a character to give substantial evidence of engineering knowledge and ability, or executive capacity of the highest order." In making this subdivision of grade 1, it is quite possible that the Joint Commission was influenced by political considerations.

The essential features of the Joint Commission's report are incorporated in the attached table which shows the salary range for the various grades of service as compared with that suggested by Engineering Council. The table also shows how the average salary as proposed by the Joint Commission, compares with the average salary received by employees in sixteen engineering bureaus in civil establishments of the Federal Government on July 1, 1919.

The research staff of the commission made estimates of the average salaries in the different classes for the engineering service which are somewhat different than the figures of column 14. They are slightly higher in the lower grades and slightly lower in the higher grades. These differences are brought about as follows: The commission's averages are for the Washington service only. The averages in column 14 include both the Washington and the field services. The commission's figures included salaries paid in civilian positions in the War and Navy Departments. The Navy Department schedule is considerably higher than that of the civil bureaus and therefore the commission's averages would be somewhat higher on this account alone. Finally, the averages will vary according to the classification of positions. It is believed that the commission classified positions more liberally than Engineering Council's committee. The commission probably included more positions in the higher grades than did council's committee, with the result that the averages for these grades are lower in the commission's than in council's calculations.

Since the commission in any comparison of proposed with existing salary scales will use somewhat different data, it is evident that the averages will not be identical. There appears no doubt, however, that in the lower two grades the averages proposed are less than the averages now paid with the bonus, but how much less will depend upon what positions are classed within these grades and what date is taken for determining the averages.

In the Professional Group, the Joint Commission recommends the same educational and experience standards for grades 5, 4 and 3 as Engineering Council, but it recommends 4 years "in the direction or performance of important engineering work" for grade 2, and 8 years for grade 1, against Engineering Council's recommendation of 3 years, and 5 years, respectively. The Joint Commission provides for a minimum increase in salary from $1,800 for grade 5 to $4,140 for grade 2; ie., $2,340, or 130 per cent in a minimum of 8 years. Engineering Council provides for a minimum increase for the same grades and number of years from $1,620 to $5,940; i.e., $4,320 or 267 per cent; more than double the rate recommended by the Joint Commission.

The increments of increase proposed for the various grades are as follows:

Grade 8 $60—7 steps to maximum
Grade 7 $120—5 steps to maximum
Grade 5 $120—3 steps to maximum
Grade 4 $120—5 steps to maximum
Grade 3 $120—5 steps to maximum
Grade 2 $180—5 steps to maximum
Grade 1 ——

"The guiding factor as to the number of steps was the consideration as to whether the position was a stepping stone to a higher one or was likely to become the life work of an employee. In the latter case more steps are provided than in the former.

"The minimum named is to be looked upon as the entrance salary of a class, i.e., new appointees are always to receive the minimum salary. This also holds with promotion into another class. The maximum salary is to be the absolute limit of compensation to which an employee can attain while in a given class."

In considering the determination of a wage policy the commission directed its attention particularly to three questions: (1) the minimum living wage; (2) the feasibility of periodic wage adjustments on the basis of the changing purchasing power of the dollar, and (3), the effect of reclassification on the lump sum and statutory methods of appropriation. The results of these investigations are given in a special report.

Courting Trouble

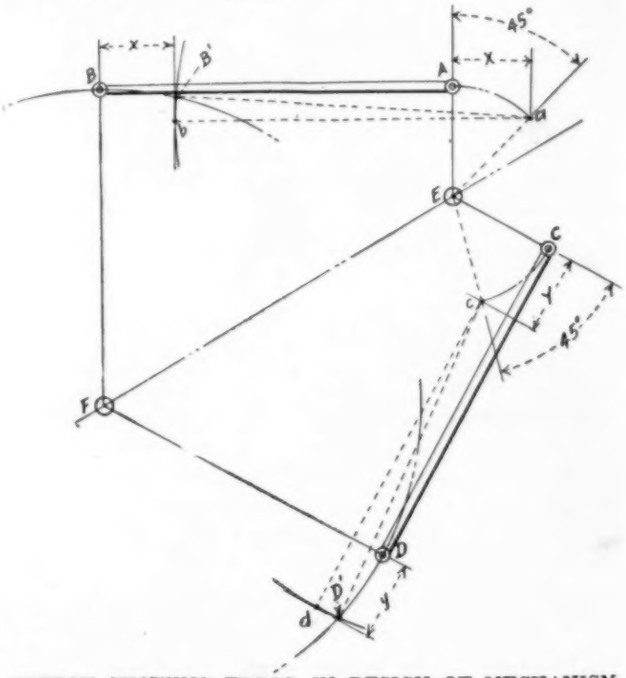
BY ARTHUR L. WILDER

On page 31 of the *American Machinist* John S. Carpenter calls attention to the poor design of the operating mechanism of an hydraulic-turbine gate valve.

The drawing printed with Mr. Carpenter's letter shows a double operating lever rotating through an arc of 45 deg. and moving, by means of two connecting rods, a gate valve which rotates about 10 degrees.

On the sketch shown herewith, *F* is the center of the gate valve and *E* is the center of the double operating arm. The connecting links are *AB* and *CD*. Swing the arm *AE* a distance of 45 deg. to position *aE*, and arm *CE* to position *cE*, and lay out line *ab* parallel to, and of the same length, as *AB* and, similarly, *cd* the same length and parallel to *CD*. It is obvious, then, the dimensions *X*, *Y*, *z* and *y*, measured parallel to lines *AB* or *CD*, are all equal.

But, when the operating arms are moved 45 deg., the connecting rods *AB* and *CD* assume the positions *aB'* and *cD'*. Then, if dimension *x* is equal to dimension *y*, arc *BB'* is greater than *DD'* due to the side swing of the connecting rods. That is, the upper connecting link will tend to move the gate valve through a greater arc than the lower link, which is obviously impossible; and the mechanism will stand rigid except for the slight amount of motion that can be obtained due to play in the joints.



SKETCH SHOWING ERROR IN DESIGN OF MECHANISM FOR GATE VALVE

An Interesting Ring Gear Job

BY I. B. RICH

The Pacific Gear and Machine Co., San Francisco, Cal., has many interesting jobs. One of them which happened to be going through at the time of my visit was the making of ring gears for repairing a lot of agricultural machinery by replacing cast ring gears with those of forged steel.

The gear housing casting at the left has to have the original cast teeth bored out to receive the steel ring gear shown in the center. These gears are made from blanks forged without a weld, opened out from a solid bar and shaped for machining in the usual way. The blanks are then turned all over as shown at the right in Fig. 1, the inside to the correct dimension but both the sides and the outside diameter being left $\frac{1}{8}$ in. large.

The teeth are cut in a Fellows gear shaper, a special chuck being provided that is easily handled and which allows the center to be kept filled with oil. As the cutter dips into this oil at every stroke it is automatically lubricated without difficulty or trouble.

After the teeth are cut a steel disk is placed in the center to prevent distortion during the carbonizing process which follows. Carbonizing is carried quite deep to insure a long wearing gear. The gear is then chucked in an engine lathe as in Fig. 2, the steel disk allowing the ring to be firmly clamped without distorting the ring with the pressure of the jaws.

The outside and both faces are then turned to size, a high-grade, high-speed steel having been found to give best results. After this, with the center disk still in place, the gear is heated and quenched. This hardens the teeth but as all the "case" has been turned from both the sides and the outside there is nothing left to harden except on the teeth. This leaves a gear with hard teeth and everything else tough, as it should be. The gear is then pressed into place and the job is done.

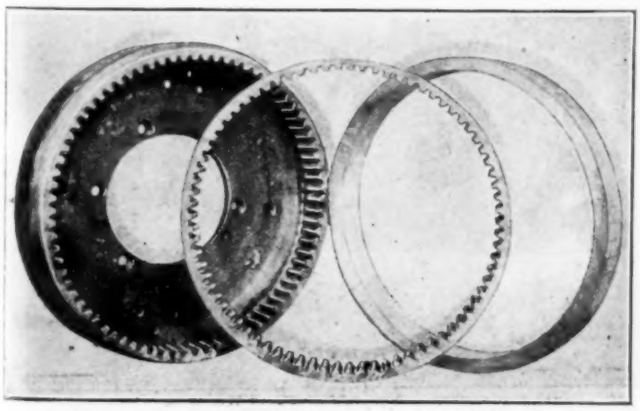


FIG. 1. THE BLANK AND THE FINISHED GEAR

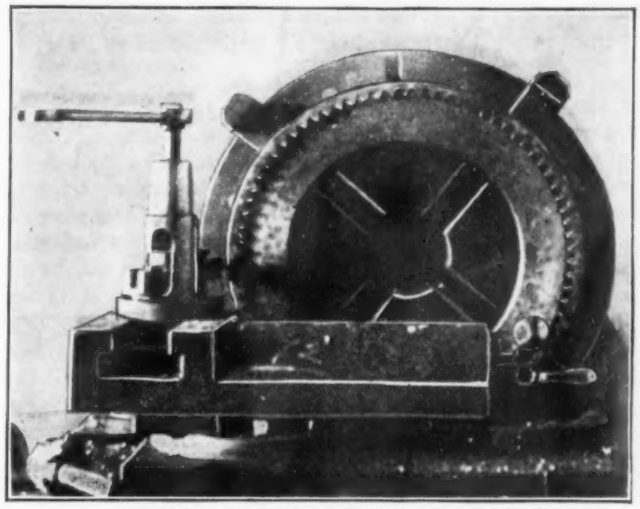


FIG. 2. FINISHING THE OUTSIDE

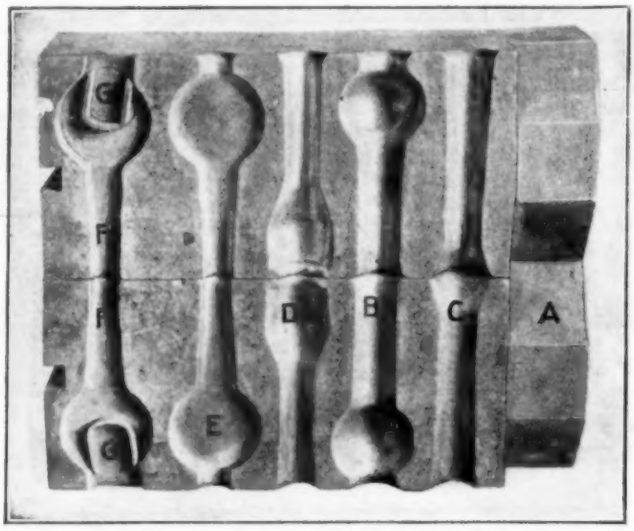
Making a Small Automobile Wrench

BY JOHN VINCENT

A common form of wrench for use on an automobile is made with a jaw on one end and a socket on the other. On account of the large quantities produced, the dies shown in the illustration were designed for rapidly forging these wrenches under a Bradley hammer.

The heated bar is first broken down between the flats *A*, and then in the pass *B* a ball is formed on each end. The handle between the balls is drawn out and finished in the pass *C*. The socket end is finished cylindrical and smooth by rotating for a number of blows in the pass *D*, where at the same time the outer end is partially snubbed off so that it can more easily be sheared off later.

The ball on the other end of the handle is flattened down in the pass *E* to form the jaw end of the wrench. It is then shifted to the final pass *F*, where the hot-chisel edge *G* removes the majority of the stock from the interior of the jaw. The hot-chisels *G* are formed



DIES FOR FORGING AN AUTOMOBILE WRENCH IN A HAMMER

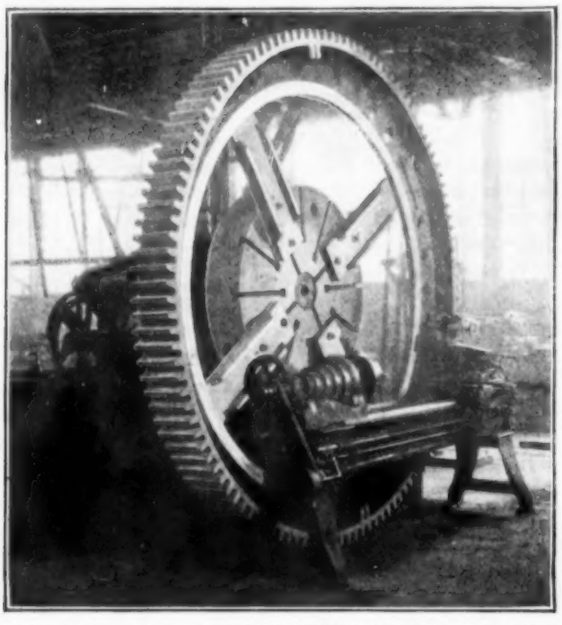
on the ends of round plugs inserted in the main dies, and are readily replaced.

The jaws are finished by grinding. The socket is first drilled to the size of the short diameter of the hexagon hole required, and then cut to shape in a punching machine with a punch corresponding to the finished size and shape of the hole desired.

Boring a Large Ring Gear Out West

BY JAMES W. SILVER

It has been for many years a prevailing idea that when a job is too big for your shop the thing to do is to turn it over to the other fellow; but out in the West in nine cases out of ten the "other fellow" is not much better equipped than you are. So when we had two large girth-gears, like the one shown in the illustration, 10 ft. 8¾ in. outside diameter with a 10-in. face, we had no machine large enough to bore and face the interior parts; our boring mill capacity being only 102 in. However, with a little study and a combination of two lathes the problem was solved. We turned the headstock on our 52-in. lathe end for end, cast four arms to fit on the faceplate, faced the outer ends of the arms and bolted the gear on. We then put a 20-in. x 12-ft. lathe parallel with the faceplate, bolted it to the floor and proceeded with the work. By this method we saved our customer a great deal of time, for if he had been obliged to send East for these gears, transportation being so badly demoralized, it would have been a long time before he could have obtained them.



A BIG JOB ON A COMPARATIVELY SMALL LATHE

Facing Some Slender Disks on the Boring Mill

BY E. A. DIXIE

The illustration shows a rather interesting job which has recently gone through our shop.

The disk *A* is 36 in. in diameter by ⅞ in. thick. The stem is 24 in. long by 7 in. in diameter and must be turned. The face of the disk must be square with the stem to within rather close limits. Several machines have been tried on the job but the best results have been obtained by facing the disk on the Colburn Mill shown in the illustration. The stem is previously turned on an engine lathe, the face of the disk being strapped to the faceplate.

The jig *B* has split hub *C* with cap *D*, secured by four screws. When preparing to bore the hub the cap was fitted with a piece of thick paper. The bore was made a neat fit for the stem of the disk. This allows the hub, with the paper removed, to securely bind the stem. Four wings *E* provide means for clamping the flange of the casting so that it will not be twisted out of square with the stem. The wings are drilled and tapped for the adjustable studs *F*, which are caused to abut against the underneath and unfinished surface of the flange, after the stem has been securely clamped in the hub. Bolts *G*, clamps *H* and "heels" *I*, are provided.

The job just about fills this size of boring mill. The cut on top varies from ⅛ in. to ¾ in., depending upon the amount by which the casting is out of true. With work as slender as this a heavy cut cannot be taken, so the output is somewhat restricted; however, under ordinary conditions, the operator can face from three to four of these castings in 10 hours.

FACING SLENDER DISKS ON THE BORING MILL

WHAT *to* READ
—*for the man in a hurry*

Suggested by the Managing Editor

THE leading article this week is by Associate Editor Sheldon. The title is "Automobile Engine Pistons as a Stock Proposition." It deals with the manufacturing operations of a company which produces pistons for all standard automobile engines. The fact that the article treats of "manufacturing" is one recommendation, and that it is written in Mr. Sheldon's clear style is another.

It is not an infrequent happening that assembly is seriously held up because of lack of production of one or more component parts. Many systems of production reports have been devised to overcome this drawback. Graphic systems, also, have been developed. One of these is explained by A. W. Sawyer in "Production Records at the Hart-Parr Factory." Page 445.

What to read was not a difficult matter to decide two hundred years ago when books were few and magazines unheard of. It is far different now when so much reading matter is offered to pass the time pleasantly or profitably as the reader chooses. We are doing our utmost to make the "American Machinist" not only profitable but indispensable as a clearing house of ideas and news of the machinery world. This page is the editors' advertisement of their section of the paper. It gives the high spots.

"Modern Welding and Cutting" is resumed after an intermission of six weeks—we now publish the twenty-fourth of this great series by Ethan Viall. The current installment deals with Welding Shop Layout, Equipment and Work Costs. Page 447.

John S. Watts gives an explanation of some of the causes of the high cost of living and labor troubles. You may not all agree with his statements—if you do, there is nothing gained by reading his argument. However, you'll need to read it to find out, and you'll find it very interesting and original. The title is "Should We Make Essentials or Non-Essentials?" Page 451.

E. A. Dixie must have an enviable time in his plant. He is a true mechanic at heart, and if we may judge from the methods he uses to accomplish difficult jobs, as told about in his articles, he is having one fine time after another. The job of making some ball-ended plugs appealed to Dixie as a job that he wanted to do for the experience. When he had finished the job he felt so good about it that he wrote it up for *American Machinist*. See what you think of it—"Making Some Ball-Ended Plugs." Page 453.

A special ball-thrust bearing supplies a subject for Western Editor Hunter's article "Press Work on the Bailey Ball-Thrust Bearing." Page 456. The article details the manufacture of this bearing, which was designed to take the place of the bronze washers used as thrust bearings in the differentials of some of the light automobiles.

The readers of the Manchester series on "The Evolution of the Workshop" will regret to learn that the current installment is the last. Many have followed this well written series with more than average interest. This week Mr. Manchester gives the history of the American metal-working industries during the Civil War. Page 459.

The report of the Classification and Compensation committee to Engineering Council is given in full, beginning on page 464. It includes a comparison of the December, 1919, report of Engineering Council's committee with the report of the Congressional Joint Commission on Reclassification of Salaries. The committee has to say: "It is the belief of the committee that, to say the least, the Federal Commission's classification, where it differs from that of your committee, has no advantages. The compensations for the various positions proposed in the Federal report are disappointing as they do not provide anything like the increases which are believed by your committee to be essential to the end that the engineering profession may attract and retain men of proper caliber to assume responsibilities successfully. The committee is hopeful that the plans which it has laid for continuing its work will bring to its assistance the earnest backing of engineers throughout the country in making the classification effective, and that information as to the value of engineering service and as to a wise employment policy will be obtained from such a wide variety of sources that it will be practicable to formulate definite recommendations along these lines."

The foregoing paragraphs are concerned chiefly with the longer articles. Among the shorter ones of note are "Operations in a New Orleans Foundry," by Frank A. Stanley, page 441; "Cost Keeping in the Small Shop," by Fred Colvin, page 442; "Combining Quantity Production with the Making of Special Parts," by Peter F. O'Shea, page 443, and "Wanted—Young Man, Fully Experienced," by Entropy.

Disfranchised Engineers

The so-called "election of officers" in a number of the big national engineering societies is an absolute farce.

A card bearing the names of the officers to be elected is sent out to the membership—only ONE nominee being listed for each office.

The "suggestion" is made in small type that if the member does not wish to vote for any of those listed he may write in the name of his choice.

What chance does any one stand of election whose name is not printed on the ballot? Not the slightest! It is a practical impossibility for a sufficient number of those opposed to any of the "selected" nominees to write in names on enough ballots to affect the final result.

Hardly a member of any of the societies following the "single-name nominee" plan has the slightest idea of who is to be nominated until he receives his "ballot."

The selection of names is made by the members of the nominating committee who are the real electors since the membership is disfranchised by the method of making out the ballots. This means that a small "group of insiders" consisting of a fractional percentage of the total membership, selects and puts into office all the national officers.

On their personal preferences and friendships rests the responsibility for the one-man-to-an-office selections made. If they selected two nominees for each office it wouldn't be so bad, but three, or even more, would be better.

The question is, "How long are the engineer members of such societies going to be content to stay disfranchised?"

Thos. Viall

Editor

EDITORIALS

The Right of Every American—Working Freedom

THERE is a part of Mr. Harding's acceptance speech which should be kept in mind by all—not especially because it comes from the Republican candidate, but because it reflects the thought of every real American:

"No party is indifferent to the welfare of the wage-earner. To us his good fortune is of deepest concern, and we seek to make that good fortune permanent. We do not oppose but approve collective bargaining because it is an outstanding right, but we are unalterably insistent that its exercise must not destroy the equally sacred right of the individual, in his necessary pursuit of livelihood. Any American has the right to quit his employment, so has every American the right to seek employment. The group must not endanger the individual, and we must discourage groups preying upon one another, and none shall be allowed to forget that government's obligations are alike to all the people."

Our ancestors came to these shores to seek religious freedom—to worship as they believed—and we Americans must not let our freedom of action in religion, life or labor be killed by those who insist that we must belong to a certain church, race, party or organization, in order to have the right to earn a livelihood or work for whom or where we please. E. V.

Increasing the Railway Car Supply by 100,000

THE Association of Railway Executives has resolved that all of its members and other carriers be urged to devote their utmost energies to the more intensive use of existing equipment." This is a good move, and is, of course, the very thing that should have been done right along, since it would have been equally effective before the grant of rate increases. However, the grant was very evidently necessary, and having been given, and approved by the country at large, the Association is to be commended for attempting real betterment before improvement can result from the rate increases.

The Association sets up several definite aims, among them "an average daily minimum movement of freight cars of not less than 30 miles per day," and "an average loading of 30 tons per car." These are the aims with which the public is chiefly concerned, not alone because of benefits from a greater movement of goods if the aims are attained, but also because of the amount of influence they may exert upon bringing these aims to a successful conclusion.

Interesting statistics are given by the Association:

"An increase of only one mile in the average movement per day would be equivalent to enlarging the available supply of cars by 100,000." This is a big figure and is worth thinking about. If a car is standing in someone's yard waiting to be loaded or unloaded it is not helping to increase the average daily movement.

"The average freight car is actually in a train moving between one terminal and another only 2.6 hours out of 24; it is actually at the service of the shipper or receiver 8.8 hours out of 24." Another statement not requiring explanation and furnishing food for thought.

The great opportunity of the buyer of car service is to use just as little as possible of the "free time" allowed for loading and unloading. All receiving and shipping departments are constantly careful not to incur demurrage; it will help out greatly, not only the railroads but the shippers and receivers themselves, if they will go a step further and save more "free time." Cars should be loaded to capacity whenever possible and should not be held in yards or on sidings when they are worth so much more rolling along. An increase of 100,000 to the available supply, without the actual addition of a single car, is an attractive proposition and one worth going after. L. C. M.

Automobile Fuels and Their Consumption

THE shortage of gasoline and its rising price naturally turns attention to the question of fuel for the hundreds of thousands of automobiles which are being built in this country each year. The first thought in most cases is to consider the use of heavier and cheaper fuels, but, according to what seems to be thoroughly reliable information, this is not the solution, as petroleum is not to be obtained in sufficient quantities.

Unless we can secure an entirely different fuel, such as alcohol, in sufficient quantities and at a low enough price, the only apparent solution is a material reduction in the amount of fuel used and this, after all, seems to be the real solution from an engineering standpoint.

Perhaps the most difficult part of the problem is the education of the motoring public away from the old standard of car perfection—the ability to "take any hill on high." It is to attain this distinction that we find huge motors of 50 to 100 horsepower in passenger cars, many times with a capacity of only three people. It is this same desire which brought about the development of the many-cylindered motor.

It is time we carefully considered the European point of view and abandoned our policy of using motors several times larger than are necessary, solely in order to avoid shifting gears on heavy grades. The European idea is to build a motor large enough to negotiate the worst hill on low gear and at low speed. Such a motor is capable of driving a car at reasonable road speed in high gear on most of our roads.

But the size of motor is not the only thing to consider. They must be made much more efficient and in this we can profit by the experience of the airplane motor builder. The Liberty motor, for example, develops a horsepower on practically a half pound of fuel, while the average automobile motor requires about double this amount. The time has come when these questions must be seriously considered by the engineers of the automobile industry. F. H. C.

What Other Editors Think

Larger Outputs with Fewer Men

From *Iron Age*

A MANUFACTURING company employing hundreds of men recently let it be known that it would hire no more workmen, for the present, at least. The psychological effect of this was apparent almost immediately in practical results. More and better work was done in that plant; there were fewer days off, less loafing on the job and greater production per man. Another company employing eighty men let thirty of them go. It was surprised to find that with the remaining fifty men it got an output equal to that which the eighty men had produced.

The cocksure attitude of workmen is not so common as it was a few months ago. In some branches of industry forces have been reduced, and while there is no great unemployment anywhere, men are becoming more jealous of their jobs. The workman, although he may not be in close touch with the "front office," knows that in some lines there have been many cancellations of orders, that production is being retarded by lack of raw materials and inability to ship.

Judging by the complaints of manufacturers, there is still much room for improvement in the attitude of workers toward their jobs, and particularly toward the common problem of maximum production. The manufacturer naturally loses patience with the worker who complains constantly of the high cost of living but on the other hand does nothing in his own job toward increasing the supply of goods.

In all the public discussions of the need for greater production, there have been few utterances from labor officials that show a proper appreciation of the true economics of the situation. It is significant, therefore, that a leading officer of the American Federation of Labor, in addressing Federation members at Montreal, pointed out that the wage earner's course is as much responsible for existing conditions and high prices as any other factor. The speaker was John H. Donlin of Chicago, president of the building trades department of the federation. In a plea for an "honest day's work" he said: "If every worker doing physical labor would insist that production equal to pre-war times would again take place there would soon be an appreciable recession in the prices of all commodities."

Speaking of another element entering into high prices Mr. Donlin said: "It is strange, but it is a fact that people complain about the price of necessities and we are squandering our money on non-essentials." He might have said, too, that it is not, for example, the bloated profiteer who today is buying silk shirts, but the workman who in days gone by would not have thought of such a piece of extravagance. "The higher the wage and the greater the underproduction," he added, "the more it is going to hurt the worker and the worker only."

If only these facts were better appreciated by wage earners better individual production might result. But, as we have pointed out repeatedly, the need of the time is not only that workers should understand that the present high wage levels mean high prices for all consumers and that the worker, when he reduces his output, thereby takes away from himself a part of any advance in wages he may secure. There is great need also—must we not say it is the first need—that both employers and employees think more of their obligations each to the other, rather than of new ways of asserting their respective rights. It has been demonstrated in many ways that even a great upheaval like the World War does not bring any radical change in human nature in industry; therefore, the cure for indifference and sloth must come through the realization by labor that the man who does not perform an honest day's work need expect little consideration when the supply of men begins to exceed the supply of jobs.

The Shipping Board Declares for the "Open Shop"

From *Manufacturers' Record*

THE Government of the United States is the Government of the whole people. Its powers cannot be exercised in behalf of any particular clique, clan, interest or organization without impairment of sovereignty.

There is no change in the character of the flame when changing from gas to ilquid fuel and the torch is readily available for use with either. For short jobs the liquid need not be turned on at all; the flame being turned on and off as required with as little trouble as an ordinary gas jet.

It is peculiarly meet and proper, therefore, that Admiral Benson, as chairman of the Shipping Board, should put that governmental instrumentality firmly on record in favor of the "open shop." Because it lays down a principle essential to the well-being of this country, the following telegram is worth reading:

Washington, July 2.

President Waterfront Employers' Union,
San Francisco, Cal.:

Further complaints are received that your organization is continuing discrimination on Shipping Board vessels. The Shipping Board must insist that proper longshoremen be given an opportunity to work on its vessels, regardless of affiliation with any particular organization. No other position is compatible with equality of opportunity for employment, which must be preserved in the public service. We do not intend to prohibit rational discrimination against individuals on account of their reputation, known participation in attacks on person or property in the course of industrial disputes, disloyalty or other legitimate disqualification for employment justifying their rejection by responsible management, nor can there be objection to reasonable means to establish the identity of such persons. Such means must under no circumstances be permitted to become or to be used as a means of arbitrary discrimination in employment. I have stated our position thus clearly in order that we may not be misrepresented by interested parties, and authorize you to give this telegram such publicity as you desire. (Signed) BENSON, Chairman.

The right of any man to work, "regardless of affiliation with any particular organization" must be forever preserved in the United States.

SHOP EQUIPMENT NEWS

-Edited By-
S. A. HAND

SHOP EQUIPMENT NEWS
A weekly review of modern designs and equipment

Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval.

CONDENSED CLIPPING INDEX
A continuous record of modern designs and equipment

Cincinnati No. 9 Internal Grinding Machine

The illustration shows the No. 9 manufacturing internal grinding machine which has recently been placed on the market by the Cincinnati Grinder Co., Cincinnati, Ohio. The machine is particularly adapted to repetition work in the grinding of either straight or tapered holes in such parts as can be revolved in a chuck or on a faceplate. It consists essentially of a swiveling wheelhead carried upon a table which is provided with longitudinal motion only; a workhead mounted on a cross-slide in such a manner as to provide a transverse movement for adjustment and feeding the work to the wheel; a reverse plate mounted on the front of the base for automatically controlling the reversal of the table; a gear box for varying the speed of the table; an automatic feeding device for the cross-slide; a gear box for controlling the rotative speed of the work; a truing diamond carrier; and a coolant system.

A constant-speed drive is employed, thus requiring only a single pulley on the overhead lineshaft. The machine may be driven through a silent chain by a motor on the floor. From the main drive shaft at the rear, the drive is through a belt at the side of the machine to the drum-shaft, running on ball bearings in the base. The spindle is driven from the drum, a fixed and a floating idler being utilized to keep the belt tight. To permit of using different sized abrasive wheels, different heads are employed, each head being a complete unit and interchangeable with the the other heads. The diameter of the driving pulley on each spindle is proportional to the diameter of the wheels to be used on the spindle

The wheelhead can be swiveled 30 deg. from its normal position, so as to get the wheel out of the way of the operator when the work is being gaged or changed.

The wheel-truing fixture is carried on a bracket at the rear of the bed, the arm holding the diamond being readily moved to bring it to the operating position.

The reciprocating motion of the table is positively driven from the main drive shaft, three changes of speed being provided by a gear box at the front of the machine. Hand operation is obtained by means of a pilot wheel. Positive stops are provided.

The Workhead

The workhead is driven from the main drive shaft, three rotative speeds being provided by means of a gear box at the rear of the machine. A belt, tightened by idler pulleys, connects the workhead with a driving pulley provided with a clutch that is automatically disengaged whenever the wheelhead is swiveled out of its normal position. Simultaneously with the

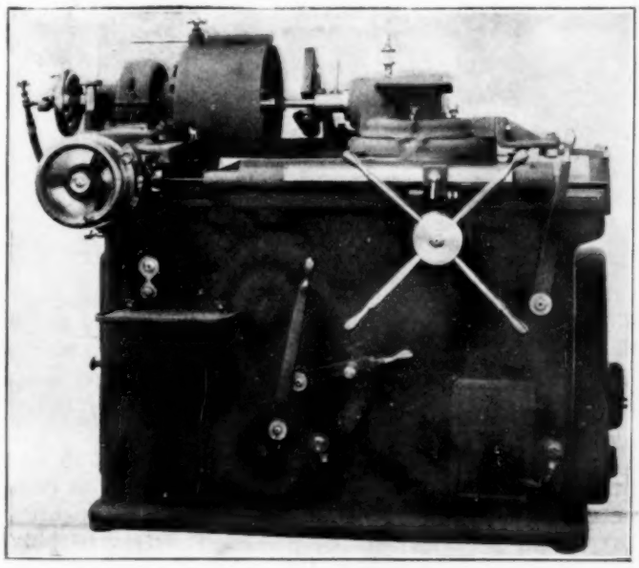


FIG. 1. FRONT VIEW OF CINCINNATI NO. 9 INTERNAL GRINDING MACHINE

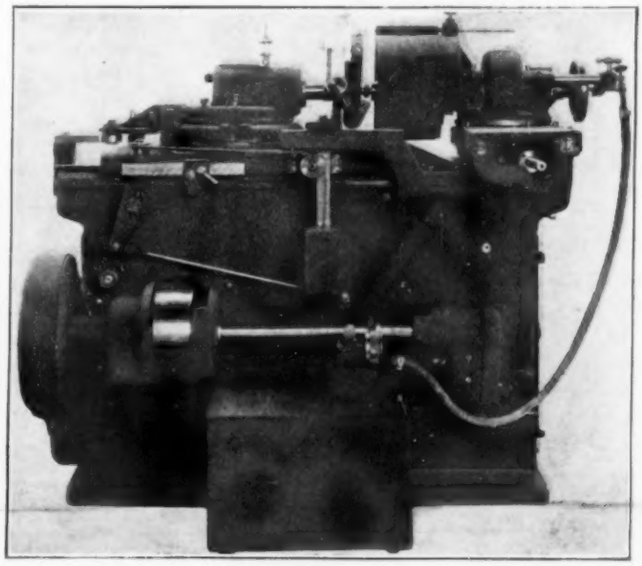


FIG. 2. REAR VIEW OF CINCINNATI NO. 9 INTERNAL GRINDING MACHINE

releasing of the clutch, a brake is applied to the pulley, thus instantly stopping the work when the wheel is swung out of the way.

The workhead can be swiveled for taper grinding to an angle as large as 45 deg. by means of the hand-wheel at the top actuating a pinion meshing with a segment on the circular base of the head.

The workhead is mounted on a cross-slide which can be fed either by hand or by power. The power feed is driven from the table motion by means of a pawl and ratchet, both the rate and the distance of travel being adjustable. A thumb latch is employed for fine feeding by hand and a handwheel for rapid traversing of the cross-slide. A direct-reading dial and positive stops are provided.

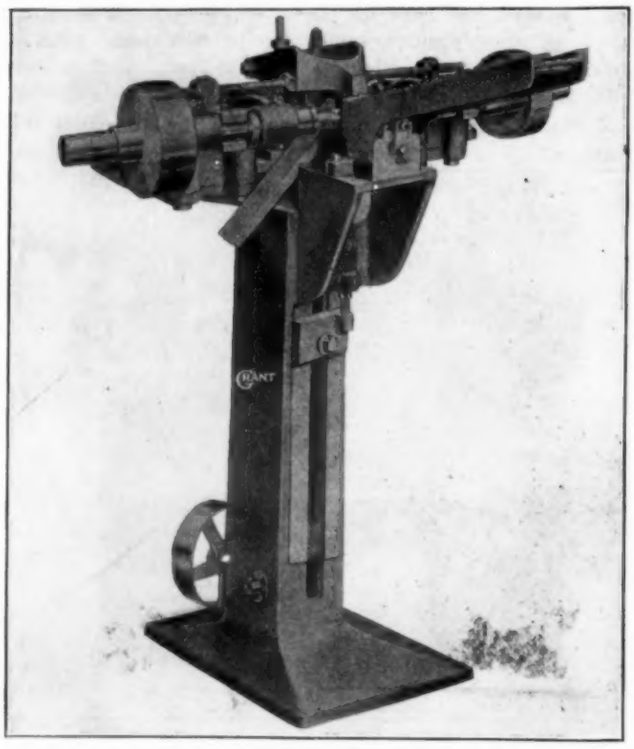
By using a cupped wheel, face grinding can be done in connection with hole grinding work requiring very accurate finishing.

The coolant pump is driven by a belt from the main driving shaft. The tank is separate from the machine, setting on the floor in the rear of it. The water guards are detachab'e from the machine, and it is claimed that they are of such size and shape as to catch all of the spray.

Grant Automatic Double-Spindle Chamfering Machine

The automatic double-spindle chamfering machine shown in the illustration was recently brought out by the Grant Manufacturing and Machine Co., 90 Silliman Ave., Bridgeport, Conn. The machine is intended for chamfering simultaneously both ends of automobile-engine piston pins; and it is claimed that a speed of 40 pins per min. with pins $\frac{5}{8}$ in. in diameter and 3 in. long can be maintained.

The pins, already cut to length from the bar or tube, are placed in the inclined hopper at the front of the machine. From the hopper they roll or slide down to the feeding mechanism, where they are taken, one at a time, by a slide and placed in the proper position in the clamp, which holds them while the cut is being taken. The opposed cutters advance from each side and chamfer the pin ends. They then recede, the clamp is released, and the feeding slide pushes another pin in place for cutting, thus ejecting the finished pin down the diagonal slide at the left of the table.

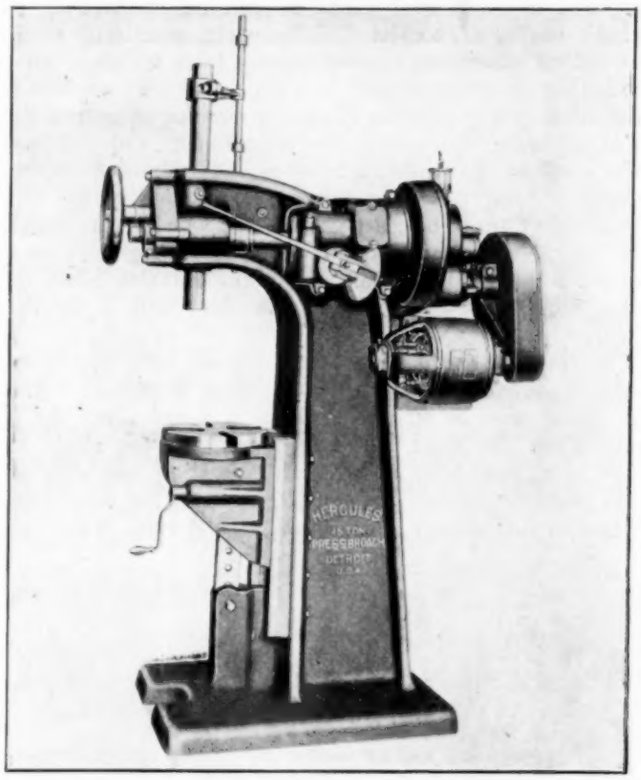


GRANT AUTOMATIC DOUBLE-SPINDLE CHAMFERING MACHINE

The use of the machine is not restricted to chamfering, as it can be applied to drilling, facing or counterboring opposite sides of small work. The work need not be round in section, as square or irregular shapes can be handled.

Hercules 15-Ton Press-Broach

The Hercules Machinery Co., Detroit, Mich., has recently re-designed its 15-ton arbor press and vertical broaching machine, shown in the illustration. It is claimed that the number of operations which the machine can handle has been increased.



HERCULES 15-TON PRESS-BROACH

The ram is driven either by a belt or by an individual motor mounted on the back of the column, and it has a travel of 18 in. The knee has a vertical adjustment of 14 in., being moved by means of a hand lever, and it is removable, so that fixtures or conveyors can be put in its place.

The press is guaranteed to have a capacity of 15 tons pressure, each machine being tested up to 18 tons pressure, at which point a pin in the drive shears in order to prevent breakage of the press. The travel of the ram is governed by means of an automatic trip.

The floor space occupied by the machine is only 6 square feet.

Guards for Modern Grinding Machines

The Modern Tool Co., Erie, Pa., is now equipping its plain cylindrical self-contained grinding machines with guards of the type shown in Figs. 1 and 2. These guards are intended to replace those of heavy cast iron formerly used, and to inclose the moving parts, at the same time permitting them to be seen.

The guard, known as the phantom type, is made of

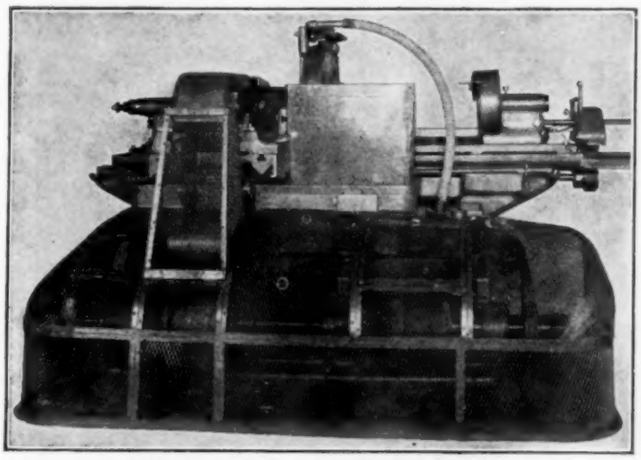


FIG. 1. PHANTOM GUARD FITTED TO MODERN GRINDING MACHINE

expanded metal riveted to a frame of angle iron. It is supplied as a unit and not in sections, and can be attached to the machine or removed without the use of a wrench or screwdriver. It is claimed that the guard is light and easily handled, but sufficiently strong to be a thorough protection to the moving parts, such as pulleys and belts, which it completely incloses. The corners are rounded so as to follow the lines of the machine, thus saving space.

Practically complete visibility of the inclosed parts

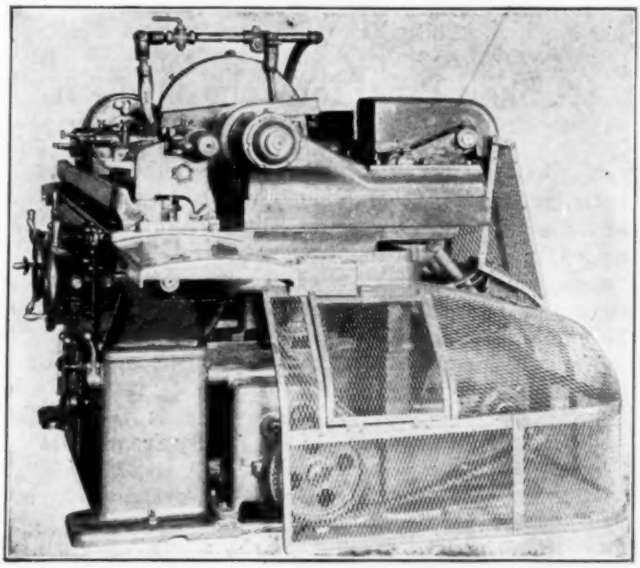
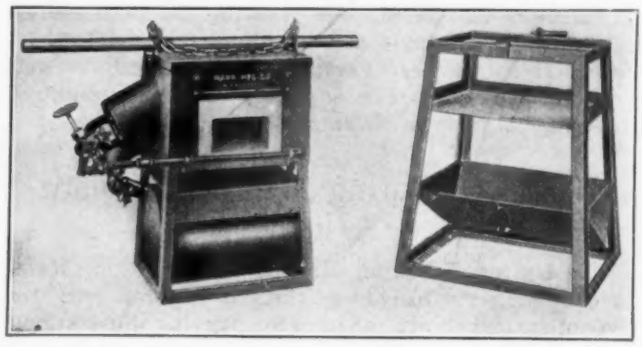


FIG. 2. SIDE VIEW OF PHANTOM GUARD ON MODERN GRINDING MACHINE

is obtained, thus insuring against the accumulation of dirt under the guards. Hinged portions and handholes are provided for the sake of accessibility, so that lubrication and minor adjustments of the moving parts can be attended to without removing the guard.

Mahr No. 12-D Hand-Portable Oil-Fuel Rivet Forge

The illustration shows the hand-portable, oil-fuel rivet forge and stand, No. 12-D, built by the Mahr Manufacturing Co., Minneapolis, Minn. This forge is intended especially for shipyard and scaffold work, and is of all-steel welded construction. It is composed of two units, the upper containing the forge and tank, while



MAHR NO. 12-D HAND-PORTABLE OIL-FUEL RIVET FORGE AND STAND

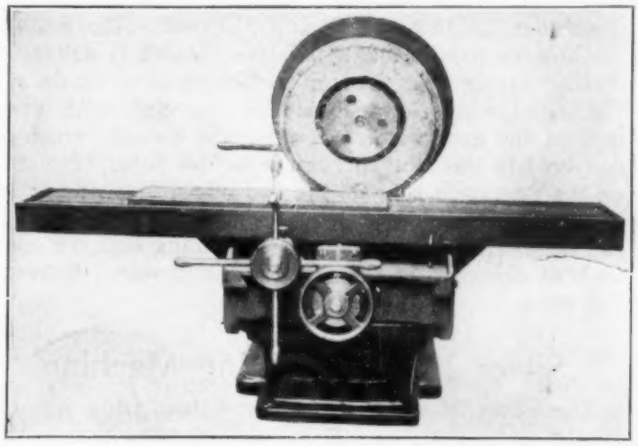
Specifications: Tank capacity, 5 gal. Oil consumption, 1¼ gal. per hour. Air consumption, 8 cu.ft. per minute. Height overall on stand, 46½ in. Floor space of stand, 13 x 36 in. Net weight: forge and tank, 165 lb.; stand, 30 lb.

the stand is arranged with a long tray and rivet bin and fitted with a clasp so that it can be secured to the forge and moved with it if desired. It has a three-piece tile lining.

The burner works on the vacuum principle and draws oil directly from the tank below, thus avoiding the necessity of carrying air pressure in the oil tank. It is claimed that the burner will handle even dirty grades of oil without trouble, and that when once adjusted the forge requires but little attention.

Face-Grinding Table for Badger Disk-Grinding Machine

The Badger Tool Co., Beloit, Wis., has developed a face-grinding table to be used on its regular line of single-spindle disk and cylinder-wheel grinding machines. The illustration shows an end view of the No. 8 machine with the face-grinding table serving a 20-in. abrasive cylinder held in a chuck. The other end



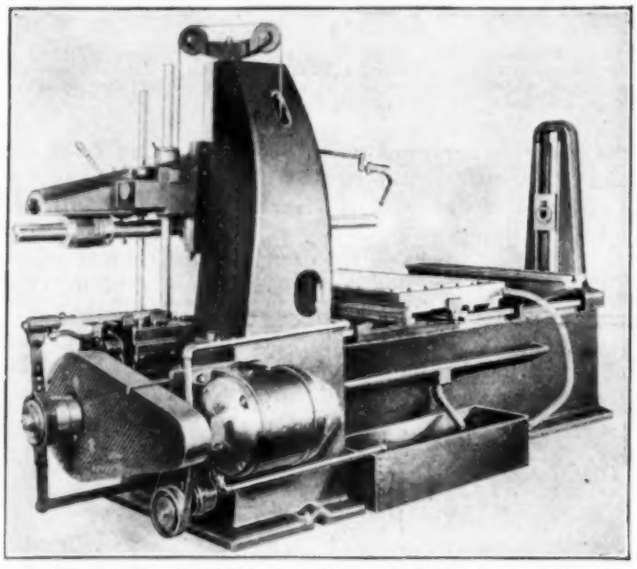
FACE-GRINDING TABLE FOR BADGER DISK-GRINDING MACHINE

of the spindle carries a 30-in. disk wheel and is served with a universal lever-feed table.

The working surface of the table is 10 x 32 in., with a longitudinal travel of 32 inches. The ways are 40 in. long, and the over-all dimensions of the table are 14 x 73 inches. Travel is produced by means of a pilot-wheel operating a gear engaging a rack, the leverage being 10 to 1. By means of a handwheel carrying a dial and operating through a screw and nut, a feed of 4 in. toward the grinding wheel can be obtained. Large adjustments can be made by moving the main saddle on the bed. All table and grinding-wheel equipments are interchangeable. Complete dust-exhaust or wet-grinding systems can be supplied. The net weight of the complete table in No. 8 size is 1,000 lb.

Universal Boring Machine Coolant System

The Universal Boring Machine Co., Hudson, Mass., is equipping its machines when so ordered with the coolant system shown in the accompanying illustration.



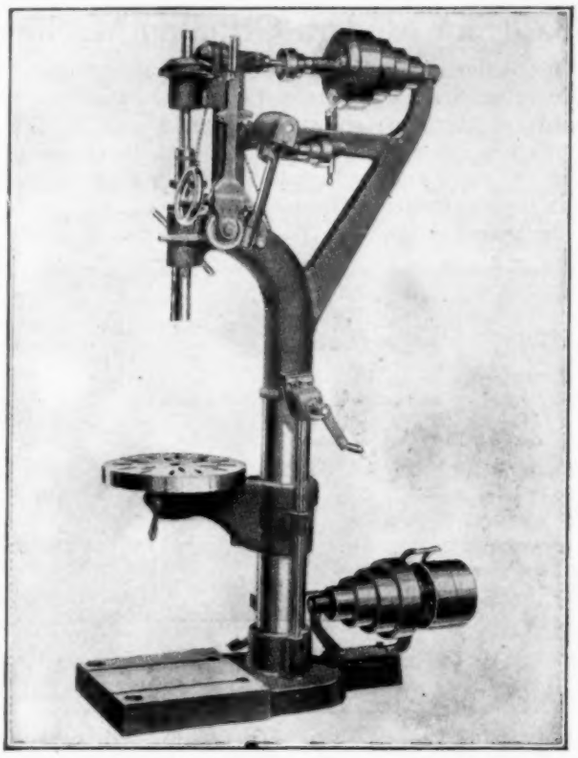
COOLANT SYSTEM OF UNIVERSAL BORING MACHINE

The pump is of the impellor type with a capacity of 12 gal. per minute, and it is driven by a belt from the motor driving the machine. The intake to the system is ¾ in. in diameter, and no part of the passage is smaller, so that all chips which enter the system are able to pass through it. The coolant is delivered to the cutting tool through a flexible-tube nozzle.

The table of the machine is provided with deep pockets and grooves for collecting the coolant, which is delivered to the tank through a flexible tube. Troughs on the front and rear of the bed of the machine serve to collect and carry off the lubricant which falls from the table. Another trough, also draining into the open tank at the rear of the machine, is provided between the ways of the bed.

Silver 20-Inch Drilling Machine

The Silver Manufacturing Co., Salem, Ohio, has recently redesigned its 20-in. drilling machine. The accompanying illustration shows the machine, the principal changes being in the style of the frame and an increase in capacity under the spindle. It is intended as a general purpose tool.



SILVER 20-IN. DRILLING MACHINE WITH POWER FEED

Specifications: Height, 75 in. Travel of spindle, 12 in. Travel of table, 17½ in. Spindle to base, maximum, 42½ in. Spindle to table, maximum, 28¼ in. Weight: net, 775 lb.; shipping, 860 lb.; boxed for export, 1,050 lb. Volume, boxed, 23 cu.ft.

The spindle is provided with an S.K.F. ball thrust bearing and usually with a No. 3 Morse taper hole. The base, as well as the table, is square with the spindle. The machine can be supplied with either hand or power feed, and with a tapping attachment if desired. It can be furnished with either geared or belted motor drive and in gangs of either two, three or four spindles.

A Short Proof for Long Division

BY J. MADDEN

The articles by Walter R. Meyer in the August 19 issue, and by E. S. Mummert in the August 26 issue of *American Machinist* on "A Short Proof for Long Division," call to mind the method of proving division by "casting out the nines." Perhaps this method is not so commonly known as one would suppose and it may not be amiss to explain it.

To cast out the nines from a number, either divide the number by 9 or divide the sum of its digits by nine. The remainder in either case is the number sought. For example, to cast out the 9's from 8761:

$$\frac{8761}{9} = 973 \text{ with } 4 \text{ left over.}$$

$8 + 7 + 6 + 1 = 22 = 9 \times 2$ with 4 left over.

Four is the working number. In practice the usual procedure is this:

$8 + 7 = 15 - 9 = 6 + 6 = 12 - 9 = 3 + 1 = 4.$

The average mental pauses would be 15, 6, 13 4; or the 8 and 1 might be grouped leaving merely 13, 4. By this it will be seen that a proof involving casting out the 9's does not add greatly to the length of the operation.

The rule for proving division is this: Find remainders by casting out the 9's in divisor, dividend, quotient and remainder. Multiply remainder from quotient by remainder from divisor. To this product add remainder from remainder. Cast out the 9's from this sum. The result, if the division is correct, will equal the remainder from the dividend. Example:

$$
\begin{array}{rrr}
 & 7 & \\
 & \| & \\
7 = 709) & 62314 & (87 = 6 \\
 & 5672 & 7 \\
\hline
 & 5594 & 42 \\
 & 4963 & 1 \\
\hline
 & 631 = 1 & 43 = 7
\end{array}
$$

The same process reversed may be used to prove multiplication. The rule is: Find the remainders from multiplicand, multiplier and product. Multiply remainder from multiplicand by remainder from multiplier. Find the remainder from their product. This remainder, if the multiplication is correct, will equal the remainder from the product. Example:

$$
\begin{array}{rr}
709 = 7 & \\
87 = 6 & \\
\hline
4963 & 42 = 6 \\
5672 & \\
\hline
61683 = 6 &
\end{array}
$$

Addition and subtraction may be proved in a similar way. Rule for proving substraction: Find remainders from minuend, subtrahend and difference. Add remainder from subtrahend to remainder from difference. Find a remainder from this sum. If the subtraction is correct, this remainder will equal the remainder from minuend. Example:

$$
\begin{array}{r}
879654 = 3 \\
123007 = 4 \\
\hline
756647 = 8
\end{array}
$$

$$8 + 4 = 12 \; ; \quad 12 - 9 = 3.$$

Rule for proving addition: Find remainder from each quantity being added and from the sum. Add the remainders from the quantities being added and find a remainder from this sum. If the addition is correct, this remainder will equal the remainder from the sum. Example:

$$
\begin{array}{r}
876579 = 6 \\
124632 = 0 \\
631854 = 0 \\
909071 = 8 \\
462175 = 7 \\
846197 = 8 \\
\hline
3850508 = 2
\end{array}
$$

To some, it may seem, after reading the preceding explanation and rules, that these proofs are complicated. I believe that if thoroughly understood and given a fair trial they will prove to be, on the contrary, quite simple.

There may be offered the objection that there is as much liability to make mistakes in casting out the 9's as in doing the original work. A little practice will show that this is not so. Even when mistakes are made in casting out the 9's they are soon discovered, as the proof is naturally the first step checked.

Representation of Local Organizations in the F. A. E. S.

The Constitution of the Federated American Engineering Societies states, in Article IV—Section 3: "provided that in the determination of the representation of local, state and regional organizations and affiliations no count shall be taken of any organization which is represented individually or through another local, state or regional organization or affiliation; . . ."

That is to say, if there were in a community five local engineering and allied technical organizations, all in a local affiliation, and one of them was a member of the Federated American Engineering Societies, then the remaining four societies would be entitled to representation as an affiliation in the Federated American Engineering Socieities, through its membership as a local affiliation, on the basis of the aggregate membership—less the membership of the local organization that already held membership in the Federated American Engineering Societies, or each of the four organizations could individually become a member of the Federated American Engineering Societies.

Revision of Weights for Sections of Minimum Web Thickness of American Standard Beams and Channels

In 1896 the Association of American Steel Manufacturers adopted a list of standard profiles of structural steel sections which are known as American Standard Structural Sections. In 1911 the association also adopted standard methods of computation for published weights and areas. The weights that were published for the minimum thickness of beams and channels did not correspond exactly to the published areas and it has long been known that it is impracticable to furnish these sections true to both the published weights and dimensions.

To correct this situation the Association has just adopted as American Standards the weights per foot shown in the third column of the table below for the section of *minimum* web thickness which do correspond to the published dimensions.

Section	Depth, Inches	Weight, Pounds per Foot	
		Present Weight	New Weight
Beams	3	5.5	5.7
	4	7.5	7.7
	5	9.75	10.0
	6	12.25	12.5
	7	15.0	15.3
	8	18.0	18.4
	9	21.0	21.8
	10	25.0	25.4
	12	31.5	31.8
	12	40.0	40.8
	15	42.0	42.9
	15	60.0	60.8
	15	80.0	81.3
	18	55.0	54.7
	20	65.0	65.4
	20	80.0	81.4
	24	80.0	79.9
	24	105.0	105.9
Channels	3	4.0	4.1
	4	5.25	5.4
	5	6.5	6.7
	6	8.0	8.2
	7	9.75	9.8
	8	11.25	11.5
	9	13.25	13.4
	10	15.0	15.3
	12	20.5	20.7
	15	33.0	33.9

The new weights as set forth above are to be put into effect Sept. 1 by all of the companies rolling these sections.

SPARKS FROM THE WOR

Valentine Francis

International Bureau of Weights and Measures Might Include Other Standards

The International Bureau of Weights and Measures will meet at Paris during September of this year. S. W. Stratton, director of the Bureau of Standards, has recently sailed to attend these sessions as the official representative of the United States.

There is in contemplation a considerable increase in the functions of the International Bureau to include other standards than those of simple weights and measures. This idea of extension of activity has been approved by representatives of the American Physical Society, the National Academy of Science, and the National Research Council.

It is anticipated that if the plan is adopted the International Bureau of Weights and Measures will have custody of numerous other types of standards and will eventually undertake the study of physical values and promulgation of constants based upon the best available information. Such constants would doubtless be adopted by most of the interested countries in the form of an international convention with respect to units and standards.

Underwood Typewriter Co. Takes Over Bullard's Bridgeport Plant

The old plant of the Bullard Machine Tool Co., of Bridgeport, Conn., located on Broad, Allen, Lafayette Sts. and Railroad Ave., has been purchased by the Underwood Typewriter Co., of Hartford, Conn., and will be used for the making of portable typewriters.

The Underwood people expect to employ between 1,500 and 2,000 workmen when this plant, which will be known as Plant No. 2, will be up to maximum production.

The Bullard company recently moved to its new plant in Black Rock, Bridgeport. The plant purchased by the Underwood company, has a total floor area of 168,222 sq.ft., and is modernly equipped; has all daylight space, adequate power plant, passenger and freight elevators, electric cranes, foundry, etc. The main building of the plant was built only a few years ago, and is a fireproof reinforced concrete structure five stories high.

Considerable alterations will be made to the plant to make it suitable for typewriter manufacturing use, and the Underwood concern expects to have the plant in operation about the middle of October.

Shall the Tail Wag the Dog?

The metric system of weights and measures having made little progress in the industries of this country, its advocates are now endeavoring to force it by law on a people who have found little merit in it.

The arguments which to their mind are unanswerable are summed up in the terms: "World Uniformity" and "Foreign Trade." They start with what they consider an indisputable assumption that the metric system users form an overwhelming majority and that the bulk of trade is carried on in their system.

But facts are stubborn things and the facts indicate that the nearest approach to world uniformity in manufacture and trade has been achieved by non-metric America and England. The overwhelming preponderance of American and British foreign and domestic trade and the dominating position held by their system of weights and measures in every commercial port have secured for them a universality, through natural processes, which no amount of compulsory legislation could have made possible.

We have only to remember that:

(1) 70 per cent of the world output of steel is manufactured in the United States and Great Britain on the inch and pound basis.

(2) Approximately two-thirds of the world production of machine tools is made to the inch.

(3) 80 per cent of the world production of screw threads is made to the inch.

(4) The United States and Canada consume for manufacture about 75 per cent of the world production of crude rubber.

(5) The United States manufactures 90 per cent of the world production of motor vehicles.

(6) The standard unit by which lumber is measured the world over is the board-foot, being a board one foot square by one inch thick.

(7) 95 per cent of the world's cotton spindles are spinning to the yard and pound; only 5 per cent are spinning to metric.

(8) Approximately two-thirds of the commerce of the world in manufactured products is on the basis of the American-English system of weights and measures.

In the light of these facts it is evident that the metric party is engaged in an effort to make the tail wag the dog.

Research Council Announces Chairmen for 1920

The National Research Council, with headquarters at Washington, D. C., has elected the following chairmen of its various divisions for the year beginning July 1, 1920:

Division of Foreign Relations, George E. Hale, director, Mt. Wilson Observatory, Carnegie Institution of Washington; Government Division, Charles D. Walcott, secretary of the Smithsonian Institution, and president of the National Academy of Sciences; Division of States Relations, John C. Merriam, professor of palæontology, University of California, and president-elect of the Carnegie Institution of Washington; Division of Educational Relations, Vernon Kellogg, Professor of Entomology, Stanford University, and permanent secretary of the National Research Council.

Division of Industrial Relations, Harrison E. Howe; Research Information Service, Robert M. Yerkes; Division of Physical Sciences, Augustus Trowbridge, Professor of Physics, Princeton University; Division of Engineering, Comfort A. Adams, Lawrence, Professor of Engineering, Harvard University; Division of Chemistry and Chemical Technology, Frederick G. Cottrell, director of the Bureau of Mines; Division of Geology and Geography, E. B. Mathews, Professor of Minerology and Petrography, Johns Hopkins University.

Division of Medical Sciences, George W. McCoy, director of the U. S. Hygienic Laboratory since 1915; Division of Biology and Agriculture, C. E. McClung, Professor of Zoology, University of Pennsylvania; and Division of Anthropology and Psychology, Clark Wissler, Curator of Anthropology, American Museum of Natural History, New York. These officers will assume charge of the activities of their individual departments.

A. I. E. E. Moves to Join F. A. E. S.

At the meeting of the Board of Directors of the American Institute of Electrical Engineers held in New York on Aug. 12 the following resolution to become a charter member of the Federated American Engineering Societies was unanimously adopted:

"*Resolved*, That the American Institute of Electrical Engineers accepts the invitation to it to become a charter member of the Federated American Engineering Societies, and pledges its hearty co-operation in the work thereof."

LD'S INDUSTRIAL FORGE

News Editor

Westinghouse Employees Take Voluntary Insurance

Over 90 per cent of the employees of the Westinghouse Electric and Manufacturing Co., at the East Pittsburgh works, have taken advantage of the additional insurance of an Insurance and Savings plan recently made effective by the organization.

This, in effect, means that nearly all employees have savings accounts, because to be eligible for additional insurance the company requires each worker to deposit a portion of his earnings in the Employees' Savings Fund.

Every employee when completing six months' service with the company is given a $500 life insurance policy, free of charge and without any restrictions. By continuing with the company and depositing, at least, 2 per cent of his earnings in the Employees' Savings Fund additional insurance of from $500 to $1,500 may be secured, the amount depending upon length of service. A policy of from $1,000 to $2,000 may, therefore, be obtained by every employee of the Westinghouse Co. depositing in the fund, which pays interest at the rate of 4½ per cent compounded semi-annually on all deposits. To assist an employee to meet an emergency, loans will be made from the Employees' Saving Fund.

Every depositor can borrow 90 per cent of the money he has in the fund, without in any way affecting the value of the insurance. Repayment can be made at the rate of 10 per cent monthly.

In addition to paying interest on the deposits, the company guarantees that the fund is not to be used for private enterprise, but is to be held in trust solely for the employee, who can withdraw his savings account with accumulated interest at any time.

The percentage of employees who have opened savings accounts with the company is much higher than has heretofore been obtained by other organizations with insurance plans. It is somewhat unique in industrial annals to know that 90 per cent of the workers in one of the largest organizations in the world have savings accounts and through their thrift have made themselves eligible for life insurance policies of $1,000 and over. It is expected that the derelict 10 per cent will soon join the ranks of the thrifty.

Individualism is a fine thing for initiative, but co-operation is necessary for progress.

Report Shows Biggest Year for U. S. Patent Office

An extraordinary increase in the business of the United States Patent Office during the fiscal year ended June 30 is disclosed by the report of the Commissioner of Patents, R. F. Whitehead, to Secretary Payne of the Interior Department, according to figures given out today.

There were 81,948 applications for inventions filed as compared with 62,755 during the previous year. The total number of applications of all kinds was 102,940, which is 27,283 more than were filed during the year 1919.

The number of patents granted, and trade marks, labels and prints registered was 47,409, an increase of 4,056 over the preceding fiscal year.

The cash receipts from all sources, the largest item of which is for first fees in connection with applications, amounted to $2,615,697.33. The total expenditures were $2,436,561.37, leaving a net surplus of $179,135.96. The total net surplus to date is $8,305,023.56. In 1918 and 1919 expenditures exceeded receipts by $27,955.62 and $65,228.13, respectively. It will be seen that the large increase of business is reflected in the net surplus of receipts during the past fiscal year.

The office shipped to foreign governments 999,862 copies of patents. It received for record 40,188 deeds of assignment.

One of the items which make up the large increase in the volume of business of the office is applications for the registration of trade marks, in which a gain of 72 per cent over the number received during the preceding fiscal year is recorded.

The gain in actual numbers of applications filed far exceeded any previous increase of business in any one fiscal year, and this gain is larger than the total receipts of any calendar year in the history of the Patent Office up to and including the year 1881.

N. I. C. Board Moves to New York

The National Industrial Conference Board announces that on and after Aug. 23 its headquarters (now in Boston) will be located at 10 East 39th St., New York City.

Business executives, economists and others interested in the board's work will find at the offices of the board much valuable information on industrial-economic subjects which is constantly being collected and analyzed by those in charge.

Consolidated Utilities Corporation Plans Wide Manufacturing Activities in the Near Future

The Consolidated Utilities Corporation, of Binghampton, N. Y., a combination of four large manufacturers, announces an extended program of business activity in the near future. The plants of the Emco Manufacturing Co., Woodworth Manufacturing Co., Osgood Scale Co., and Jones of Binghamton Co., have been acquired by the new concern and plans are now under way to set the machinery of the combination in motion for united production of automobile accessories, motor parts, belting and guards, chains and scales.

A recent addition to the Osgood Co.'s plant will enable the new body to produce a maximum of the well-known Osgood scales. A new concrete addition to the Woodworth factory is contemplated so that the production of this branch can be greatly increased.

Worrall & Kling Open Youngstown B. & T. Agency

H. C. Worrall, general sales manager of the Gilbert & Barker Manufacturing Co., and Elmer Kling, in charge of the factory sales department of the same concern, have resigned their positions to enter business for themselves.

Worrall & Kling have opened offices in the Stearns Building as sales representatives of the Youngstown Boiler and Tank Co., specializing in large and small storage tanks as well as pressure tanks and miscellaneous plate work, such as steel stacks, bins, etc. It is their intention as manufacturers' agents to add a few kindred lines.

Handley Page Co. to Build Freight Airplane

It is understood that the Handley Page Co., of England, will soon construct a special airplane suitable for carrying freight. This has been made necessary owing to the increased quantity of heavy and bulky freight which is now being carried to and from Paris by the company.

The new machine will be one of the 0-11 types and will have a large freight hold with a passenger cabin for two or three at the back and also a room will be made in the nose of the airplane for two passengers in addition to the pilot and mechanic.

Geo. B. Hodges Joins McVicker Engineering Co.

The McVicker Engineering Co. announces that George B. Hodges has been appointed manager of the industrial and production department.

Mr. Hodges has been identified with the production and industrial work on tractors, plows and power farming machinery for the past eighteen years.

The McVicker Engineering Co.'s service policy, in connection with the production work, is practically the same as with their consultation service, and enables companies in need of production and industrial service to get Mr. Hodges' assistance at a very moderate remuneration.

Engineers and architects from all parts of the State of Minnesota met at Duluth recently and took the first steps toward the formation of a state federation of engineers and architects.

Akron Public Works to Buy Machinery

Approximately $150,000 worth of machinery will be needed by the Akron department of public works next year, according to F. C. Tolles, superintendent.

The street cleaning department requires another sweeper and at least one more auto truck, he said. The street repair department will need four heavy tractors, a steam roller and a breaking plow. The garbage collection department will require at least one more truck and twenty additional trailers, Mr. Tolles said. The trailers used by the garbage collection department this year have proven successful.

The city started a policy of purchasing machinery to do a large part of the public work two years ago.

A large sum will be asked to equip the city yard with bins and tanks for storing material.

DOMESTIC EXPORTS FROM THE UNITED STATES BY COUNTRIES, DURING JUNE, 1920
METAL-WORKING MACHINERY

Countries	Lathes 491	Other Machine Tools 492	Sharpening and Grinding Machines 493	All Other 495
Belgium	$34,875	$16,356	$8,847	$54,803
Bulgaria		624		
Denmark		358	298	1,130
Finland		586	71	
France	71,627	192,051	19,543	126,578
Greece		1,331		
Italy	13,625	48,311	16,981	14,510
Netherlands	4,565	36,691	11,574	12,613
Norway	1,211	1,753	2,895	4,887
Poland and Danzig			500	
Portugal		1,903		1,595
Roumania		168		
Spain	25,530	23,888	1,525	9,672
Sweden	5,014	34,673	15,575	13,250
Switzerland	3,017	190	1,580	589
England	266,968	210,442	86,514	330,642
Scotland	133	11,431	608	
Ireland		1,468	962	
Bermuda		138		
British Honduras			33	
Canada	141,814	196,969	74,092	191,458
Costa Rica		697		
Guatemala		80	10	119
Honduras		73		225
Nicaragua				9
Panama		1,274		576
Salvador		487	15	
Mexico	13,211	3,667	8,609	12,045
Newfoundland and Labrador	4,359	207		370
Jamaica		1,492		2,215
Trinidad and Tobago	75	23,274		
Cuba	6,369	27,870	983	5,482
Haiti			30	
Dominican Republic	90	373	820	
Argentina	16,940	11,332	7,307	14,812
Brazil	2,037	8,528	1,811	7,579
Chile	547	3,935	2,084	836
Colombia	1,221	6,531	25	24
Ecuador	784	259		
Dutch Guiana		64		
Paraguay		127	51	
Peru	6,133	220	177	8,635
Uruguay	3,231	668	225	231
Venezuela		2,587	93	8,600
China	19,460	17,945	1,206	4,133
British India	21,440	26,349	4,684	113,411
Straits Settlements		244		
Other British East Indies		54		
Dutch East Indies	4,789	5,190	250	6,097
French East Indies				125
Hongkong	1,198	180	1,258	303
Japan	123,536	133,725	101,919	146,894
Siam			12	
Turkey in Asia		35		
Australia	30,610	40,035	15,157	17,648
New Zealand	3,422	7,793	986	191
French Oceania				965
Philippine Islands	8,186	2,938	438	1,750
Belgian Kongo			460	
British West Africa	25			
British South Africa	3,755	18,002	1,746	17,529
British East Africa			3,805	1,829
Canary Islands		1,027		
French Africa		223		
Kamerun, etc	250	34		21
Portuguese Africa	300	270	144	
Egypt	6,236	177		559
Total	846,583	1,127,297	395,903	1,134,940

Gilbert & Barker Make Changes in Personnel

The sales department of the Gilbert & Barker Manufacturing Co., of Springfield, Mass., has announced the following changes at various offices of the company: Mr. Crosier, assigned to Los Angeles from Denver; Mr. Coolbroth, from Little Rock, Ark., to Portland, Ore.; Mr. Chauncey, from San Franciso to factory at Springfield, Mass.; Mr. Flynn, from plant to San Francisco, and Mr. Farrell, from plant to Portland, Ore.

J. F. Hamblen, formerly of the New York City sales force, has been assigned to the Sacramento, Cal., office of the company.

S. J. Taylor, formerly in charge of the Sacramento, Cal., office, has been transferred to San Francisco.

O. J. Skinner, formerly of the Standard Oil Co. of California, has joined the San Francisco office of the Gilbert & Barker Manufacturing Co., of Springfield, Mass.

Catalogs Wanted

The Aws Manufacturing Co., 398 Harman St., Brooklyn, N. Y., would be pleased to receive catalogs from manufacturers of machinery and tools with special reference to the manufacture of low-pressure valves, non-ferrous foundry equipment; also other catalogs of engineering interest for its files.

Forthcoming Meetings

The American Railway Tool Foremen's Association will hold its annual meeting at the Hotel Sherman, Chicago, on Sept. 1 to 3.

The National Gas Engine Association, Monadnock Bldg., Chicago, Ill., will hold its thirteenth annual convention at the Congress Hotel, Chicago, on Sept. 1, 2 and 3.

The American Steel Treaters' Society and the Steel Treating Research Society will hold their second annual convention and exhibition at the Commercial Museum, Philadelphia, Pa., on Sept. 14 to 18, inclusive. J. A. Pollak, of the Pollak Steel Co., Cincinnati, Ohio, is secretary of the former society.

The National Safety Council, 168 North Michigan Ave., Chicago, Ill., will hold its ninth annual safety congress in Milwaukee on Sept. 27 to Oct. 1.

The American Foundrymen's Association will hold its annual convention and exhibit at Columbus, Ohio, on Oct. 4 to 9. C. E. Hoyt, 1401 Harris Trust Building, Chicago, Ill., is secretary.

An exposition of U. S. manufacturers at Buenos Aires, Argentine Republic, S. A., has been arranged for the month beginning Nov. 15. Information can be obtained from the American National Exhibition, Inc., Bush Terminal Sales Building, 132 West 42nd St., New York.

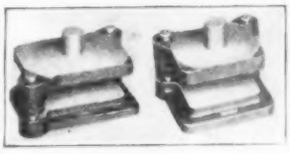
The National Machine Tool Builders' Association will hold its 19th annual Fall convention at the Hotel Astor, New York City, on Thursday and Friday, Dec. 2 and 3, 1920. C. Wood Walter, care of the association at Worcester, Mass., is secretary.

The 1920 annual meeting of the American Society of Mechanical Engineers will be held in the Engineering Societies Building, 29 West 39th Street, New York City, from Dec. 7 to Dec. 10.

Condensed-Clipping Index of Equipment

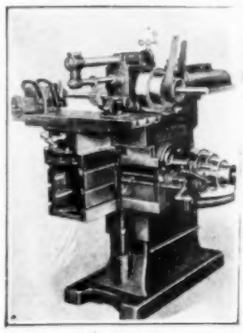
Patented Aug. 20, 1918

Sub Press, "U. S."
U. S. Tool Co., Inc., 51-53 Lawrence St., Newark, N. J.
"American Machinist," Aug. 12, 1920



These sub-presses are intended for accurate work under a press ram. Special presses are built to suit particular jobs, and stock ones are carried in a range of platen sizes from 2 x 3 in. to 6 x 8 in.

Milling Attachment, Shaper, "Tri-State"
Tri-State Milling Machine Co., Memphis, Tenn.
"American Machinist," Aug. 12, 1920



This milling attachment is intended for application to a shaper, it being mounted in the shaper ram-way after the ram has been moved back. The spindle is worm driven and is supported by a substantial overarm. The size and make of the shaper on which the attachment is to be used should be given when ordering. One arbor is furnished with the attachment. Diameter of cone pulley steps, 4, 6, 8 and 10 in. Table, 3 ft. long; mounted on swivel base. Crossfeed, 7 in.

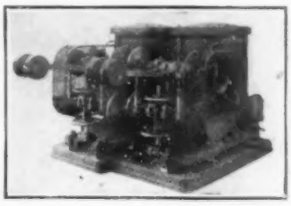
Toolrack, "International"
International Purchasing Bureau, 203 East 15th St., New York, N. Y. "American Machinist," Aug. 12, 1920

This rack or stand consists of cast-iron trays arranged to swivel. The small round tray at the top is intended to hold small tools such as micrometers.

Glue Pot, Electric, Dry-Type, "Westinghouse"
Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.
"American Machinist," Aug. 19, 1920

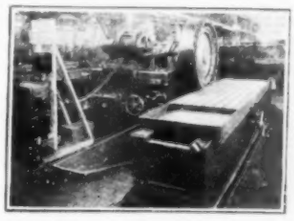
This is a two-quart size, electrically heated, dry-type glue pot, of the type described in the "American Machinist" of March 20, 1919. The time taken to heat the glue is approximately 15 minutes. Sizes made, 1 pint, 1, 2 and 4 quarts.

Welding Machine, Spot, Automatic, Channel, "Federal"
Federal Machine and Welder Co., Warren, Ohio
"American Machinist," Aug. 12, 1920



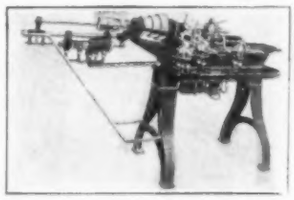
The machine is intended for welding together two steel channels to form an I-beam. Channels from 4 to 16 in. in depth can be handled, two spot welds from 4 to 12 in. apart being made simultaneously. A motor feeds the work at a speed of from 25 to 60 ft. per min. The machine is capable of welding two spots at a time on two pieces of material ¾ in. thick at the rate of 60 welds per min. The welding current is controlled by auto transformers in the primary circuit in eight equal steps from 65 per cent to full line voltage, two 220-volt air-cooled transformers being provided. Copper disks are used to make the contact necessary for the secondary or welding current.

Grinding Machine, Face, Extra-Heavy-Duty, "Diamond," 54-In.
Diamond Machine Co., 9 Codding St., Providence, R. I.
"American Machinist," Aug. 12, 1920



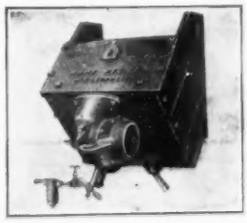
The machine is intended for heavier and larger work than any machines heretofore built of this type. A sectional-type grinding wheel is used, consisting of a number of abrasive blocks held in a chuck. The coolant tank is of large area, so that the necessary volume of coolant is of moderate depth, which facilitates the settling of sediment. Two sets of centralized controls are provided. The drive is by a motor mounted on the grinding wheel head, from which power is delivered to the spindle through a Morse silent chain. Spindle, 9 in. diameter. Grinding wheel, 54 in. diameter. Platen; width, 36 in.; longitudinal travel, 134 in. Speeds of table, 12, 17, 22, 28 ft. per min. Speed of grinding wheel, 324 r.p.m. Feeds, 0.002 to 0.20 in. per stroke of table. Motor, 100 hp. Approximate weight boxed for shipment, including motor, 35,000 lb.

Lathe, Turret, Hydraulic, "Moretti"
Alfred Herbert, Ltd., Coventry, Eng., and 54 Dey St., New York, N. Y.
"American Machinist," Aug. 19, 1920



The movements are operated hydraulically, the machine being intended for operation by disabled men. A minimum pressure of 75 lb. per square inch is required for operating the cross-slide, turret and chuck, the action of the actuating pistons being controlled by valves. The turret slide is provided with automatic stops. The drive is through a 3-step cone pulley. Swing over bed, 12 in. Bore of chuck, ¾ in. Turret; stroke, 3 in.; diameter, 5 in.; tool holes, 1 in. Range of feeds to cross and turret slides, ¾ to 80 in. per min. Floor space, 2 ft. x 5 ft. 8 in. Weight; net, 770 lb.; shipping, 1,000 lb. Cu.ft., 60.

Calorizor, Oil or Gas, Industrial Furnace, "Mahr"
Mahr Manufacturing Co., Minneapolis, Minn.
"American Machinist," Aug. 19, 1920



This device is intended for attachment to industrial furnaces, it being a combination of oil atomizer and gassification and combustion chambers. It is made in angle and straight types. The former, which is illustrated, is recommended for moderate-temperature work, as in annealing furnaces and core ovens, and the latter type is for high-temperature work where a strong reducing action is required, as in drop-forging furnaces. Low-pressure air is used for both atomization and combustion, the pressure being not less than 8 oz. per square inch. Any grade of oil or gas can be used by making a slight change in the calorizor. There are three sizes, with oil-consumption capacities for the straight type of 5, 8 or 12 gal. per hour, and for the angle type of 4, 7 or 10 gal. per hour.

Clip, paste on 3 x 5-in. cards and file as desired

Business Items

Los Angeles Gas and Electric Co., of Los Angeles, Cal., has arranged an appropriation of $2,500,000 for extensions and improvements to its plants and system.

United Machine and Manufacturing Co., of Akron, Ohio, has had plans drawn up for the construction of a new foundry, 100 x 200 ft., to cost $100,000. including equipment.

Witherow Steel Co., Pittsburgh, operating a plant at Neville Island, is planning for the manufacture of electric steel at its plant at Fayette, near Connellsville, Pa., recently acquired from the Connellsville Electric Steel Co. The company has a tract of 25 acres of land at this place, and included is the property of the former Keystone tube mill. G. R. Norton, former vice-president and works manager of the Sizer Forge Co., Buffalo, will be manager at the plant.

The Ewald Iron Co., of Louisville, which manufacturers parts of locomotives that are used by more than fifty railroads, has announced a program of expansion which includes the rebuilding of the present plant, which has a capacity of 12,000 tons annually, with a $3,000,000 plant with yearly output of 50,000 tons of iron. It is estimated that the new plant will be in operation some time in 1922, and that the payroll will include 1,000 men.

The Bayside Foundry Co., Inc., of Fall River, Mass., recently organized, has closed negotiations to take over the Mechanics Foundry plant on Davol St. and Remington Ave., Fall River. The present Mechanics Foundry has a capacity output of fifteen tons a day, but the new concern plans to greatly increase this as soon as the organization is completed.

The Universal Chain Co., Inc., of Hartford, Conn., was recently organized to deal in chains, tools, machines, etc. The capital of the company is $500,000, and the organizers are Howard A. Flagg, 1291 Farmington Ave., West Hartford; D. C. McCarthy and P. G. Hayes, of Hartford, Conn.

The New England Smelting and Refining Co., Inc., of Ansonia, Conn., has recently been organized to deal in metals, etc. Address S. J. Liftig, 52 Platt St., Ansonia. The capital of the new company is $50,000.

The Burke Electric Co. wishes to announce the appointment of L. L. Myers as general Western sales manager. Mr. Myers' headquarters will continue to be in the Illuminating Building, Cleveland, Ohio, where he has been the Burke Electric Co.'s sales representative for the Cleveland territory for several years.

L. B. Ritchie has been appointed general Eastern sales manager, with headquarters at 30 Church St., New York.

The American Steel and Wire Co., of Worcester, Mass., has awarded the contract for a combination office and recreational building at the Kansas St. works of the plant in Worcester. The new building will be two stories and basement high, 50 x 90 ft., and will cost approximately $50,000. It will be of brick and steel construction. The recreational portion of the structure will contain an auditorium, with stage, etc., and will have all features of such buildings. The building will face on Cambridge St.

The Wickwire-Spencer Steel Corp., of Worcester, Mass., and Buffalo, N. Y., will transfer its welded fabric department from the Clinton, Mass., factory to the works at Buffalo shortly, so as to be nearer the source of raw material supply.

The American Machine Co., of Hartford, Conn., has recently increased its capital from $50,000 to $100,000.

Trade Catalogs

Metal Melting Pots. Cutler-Hammer Manufacturing Co., Milwaukee, Wis., 2-page illustrated circular, 8½ x 11 in., descriptive of C-H Melting Pots, both portable and bench types. These heating pots are especially serviceable for melting lead, tin, solder, babbitt, etc., and maintaining these metals at the proper temperature. The heat may be controlled by means of a rotary snap switch or an automatic control device which maintains the temperature at the desired point. The leaflet is known as Publication 826.

Technologic Paper, No. 164, "Saybolt Viscosity of Blends." Department of Commerce, Bureau of Standards, Washington, D. C., prepared by Winslow H. Herschel, associate physicist Bureau of Standards. A truly technical treatise on the blending of oils, crudes and gasoline, giving tables and charts for determining the viscosity of various blends. Copy can be had by addressing the above bureau.

Square D Safety Switches. The Square D Co., Detroit, Mich., Catalog No. 25, pp. 40, 8½ x 11¼ in. A well-written catalog with many elaborate illustrations of Square D products, including safety switches, steel enclosed industrial control switches, service entrance switches, motor starters, compensator type switches, plug receptacles, iron-clad switches, meter protective trims, accessories.

Yarway Blow-off Valves. Yarnall-Waring Co., Philadelphia, Pa. Catalog B-410, pp. 15, 6 x 9 in., giving full descriptions with illustrations of the latest development in Yarway seatless and double-tightening blow-off valves. These models are made to conform with the A. S. M. E. boiler code.

Blanchard Grinders. The Blanchard Machine Co., 64 State St., Cambridge, Mass. Catalog, pp. 63, 4 x 7½ in. This catalog contains illustrations, drawings and production data on fifty different jobs which are being machined on Blanchard surface grinding machines. This catalog is intended for managers, superintendents, tool engineers and foremen.

Plain, Limit and Standard Gages, Société Genevoise D'Instruments De Physique. The Golden Co., 405 Lexington Ave., New York, sole representatives. Catalog No. 261, pp. 42, 5½ x 8½ in. This catalog describes and illustrates the various gages made by this firm, and also includes tables and diagrams of fits and tolerances for various kinds of work in interchangeable manufacture.

How to Systematize the Stockroom. Haddon Bin Label Co., 206 W. Atlantic Ave., Haddon Heights, N. J. Catalog 3½ x 6½ in.; pp. 8. Illustrating and describing various Haddon stockroom accessories, including bin tags, labels, files, stock boxes and containers; also suggestions for laying out a stockroom.

Personals

SAMUEL M. HERSHEY, formerly manager of the Philadelphia office of the Heald Machine Co., of Worcester, Mass., is now sales manager of the A. B. Landes & Son, of Philadelphia, specialists in external grinding, etc.

A. R. SLEATH has been made Philadelphia manager for the Heald Machine Co., of Worcester, Mass. Mr. Sleath was formerly the Southern representative of the company, before taking up his duties in the Philadelphia branch office.

W. A. ERICKSON, of the Heald Machine Co., of Worcester, Mass., who was recently appointed to the New York City office of the company, has now been transferred to the Buffalo offices, as sales manager of the western New York district.

ROGER B. HUBBELL, who has been assistant sales manager of the Heald Machine Co., Worcester, Mass., for several years, recently resigned his position to retire.

CLAUDE JOHNSON, managing director of Rolls-Royce, Ltd., and chairman of the American works, is here supervising work on the building of the Rolls-Royce car in America. He says the English works is sold two years ahead. The product of the English and American shops, Mr. Johnson declares, will be identical, pointing out that there is no confusing foreign language or METRIC SYSTEM to hinder perfect performance.

A. W. SCHENKER, formerly with The United States Aluminum Co., Edgewater, N. J., has resigned to assume the offices of president and treasurer of the Aws Manufacturing Co., with its main offices and works at 400 Harman St., Brooklyn, N. Y. The company manufactures a complete line of low-pressure valves and cocks for gas, air, oil, and water. Also other non-ferrous fittings and specialties.

EDWARD F. WELLMAN has been appointed a member of the sales force of the Graton & Knight Manufacturing Co., of Worcester, Mass., makers of factory leather belting, etc. Mr. Wellman will work in Maine, which is his native state.

PHILIP J. WORSLEY, of Guest, Keen & Nettlefolds, Ltd., Birmingham, England, sailed for home, Aug. 28. Mr. Worsley has been in the United States for about six weeks looking up wood screw machinery and inspecting some of our large industrial plants and manufacturing centers.

FREDERICK WAKEMAN, chief engineer of Guest, Keen & Nettlefolds, Ltd., Birmingham, England, sailed for home on the Olympic, Aug. 28. He has been in the United States several weeks in the interests of his firm and in getting acquainted with American methods of manufacturing.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Strainer, Oil or Water, "Griscom-Russell"
Griscom-Russell Co., 90 West St., New York, N. Y.
"American Machinist," Aug. 19, 1920

This device is intended for straining either oil, as in a lubricating, fuel or quenching oil system, or water, as on a supply line from a lake. The body of the strainer is cast iron and the strainer basket is perforated sheet steel, the basket being lined with wire mesh when the strainer is used on an oil line. The strainers are made with either screw or flange joints, for pressures up to 300 lb. per sq.in., and are furnished in a range of sizes to fit pipe from 1 to 6 in. in diameter, the smallest size weighing 15 lb. and the largest 550 lb. The strainer may be installed as a single unit or in a set, consisting of two strainers and two three-way valves with the necessary connections. The use of the set permits the cleaning of either of the two units without interruption of the service.

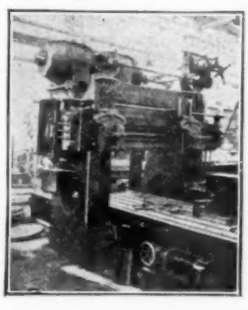
Sander, Belt, Automatic-Stroke, "Mattison," No. 124
Mattison Machine Works, Rockford, Ill.
"American Machinist," Aug. 19, 1920

The machine is intended to eliminate hand-stroking by the use of a device which automatically presses the sand-belt against the surface being sanded. The columns of the machine are mounted on a cast-iron base, and a casting across the top carries all of the power-drive mechanism. At each end of the casting the heads for the sand-belt pulleys are mounted on ways to permit adjustment of the belt tension. The shoe for applying the sand-belt slides on a bar extending across the front of the machine, it being driven with a rapid reciprocating motion by a steel belt running over two flanged pulleys. The reciprocating parts are made of aluminum. The length of stroke can be varied to suit the work, and two speeds are provided for the shoe, which may be disconnected from the belt for hand-stroking. The work is carried on a light table mounted on ball-bearing rollers and adjustable for height.

Welding Machine, Seam, Electric, "A-1"
A-1 Manufacturing Co., Bradford, England
"American Machinist" (European Edition), July 3, 1920

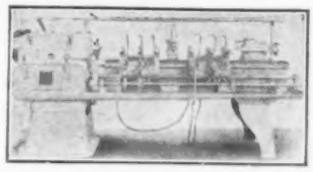
The machine is intended especially for welding longitudinal seams of drums as small as 9 in. in diameter, handling a total thickness of metal of $\frac{3}{8}$ in. Clamps hold the work in position on the long arm, stops being provided so as to insure alignment of the edges of the sheet. The lower arm has a copper-strip electrode and is water cooled. The upper electrode consists of a roller mounted on an arm, its motion being controlled by means of a pedal. An automatic trip is provided for the travel of the roller. By means of a plug box, eight heating speeds are obtainable. Drums welded on the machine can be corrugated or spun afterward.

Control, Planer, Electric, "Thompson-Houston"
British Thompson-Houston Co., Ltd., Rugby, Eng.
"American Machinist" (European Edition), July 17, 1920



The device is intended for controlling the action of a planer table, starting, stopping, reversing and speed variation of the motor being automatically accomplished merely through the pressing of the control buttons. The control operates on the Ward-Leonard system, the driving motor being separately excited and having a variable voltage impressed across the armature terminals. The complete equipment consists of a motor-generator set, variable-speed reversible driving motor, rheostats, master controller for table motion, automatic contactor equipment, control gear for the motor-generator set, limit switch to open contactors and apply dynamic braking in case of over-run of the table, and push-button stations. Different arrangements for mounting the motors and equipment can be provided.

Lathe, Geared-Head, "Lo-Swing," 4-Inch
Fitchburg Machine Co., Fitchburg, Mass.
"American Machinist," Aug. 19, 1920



The machine is intended for shaft turning, it being fitted with two carriages, each carrying three tools and running on V's so located that the carriages can be run past the tailstock. The machine has a constant-speed drive and the speeds are controlled by the two upper levers on the headstock, while the feeds are controlled by the two lower levers. With the drive pulley running at 500 r.p.m., six speeds varying from 38 to 316 r.p.m. and nine feeds from 0.007 to 0.120 in. per rev. of the spindle are available. Flexible tubes carry coolant to the tools and to the tail center. The shipper rod runs the whole length of the machine. The lathe swings 4-in. in diameter and is made in three lengths to accommodate work up to 60, 80 or 108 in. between centers. The 60-in. lathe requires a floor space of 37½ x 123 inches.

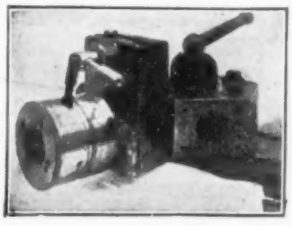
Heater, Rivet, Electric, Portable, "A-1"
A-1 Manufacturing Co., Bradford, England
"American Machinist" (European Edition), July 3, 1920

The machine is intended for heating rivets, being made in four sizes from 10 to 30 kw. capacity. It has three independently operated sets of electrodes, so that three rivets can be heated simultaneously. No switch is employed, the circuit being closed by inserting a rivet between the electrodes, the bottom electrode of each pair being lowered for this purpose by means of the pedal. The machine requires no preliminary heating up, and the rivets are kept clean and free from scale. Flexible copper conductors join the electrodes and the transformer. Eight heating speeds are obtainable by the use of the plug box. The machine is portable, the tray being provided for carrying the rivets.

Grinding Machine, Surface, "Armstrong-Whitworth"
Armstrong, Whitworth & Co., Ltd., Openshaw, Manchester, Eng.
"American Machinist" (European Edition), July 10, 1920

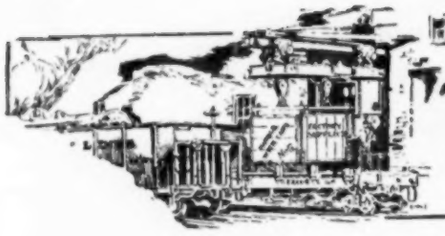
The machine is intended for plane grinding on work up to 24 in. long, 6½ in. wide and 9½ in. high. The abrasive wheel used is 7 in. in diameter, it being adjustable for height by means of a handwheel. The table is 57 x 8½ in. and has three T-slots. A vise having an opening of 2 in. is provided. The travel of the table is automatic, being controlled by dogs operating the reversing lever. The power crossfeed has an automatic trip. The machine weighs approximately 12½ cwt.

Holder, Die-Head, Elevating, "Herbert"
Alfred Herbert, Ltd., Coventry, Eng.
"American Machinist" (European Edition), July 17, 1920



This die-head holder is intended for use on the No. 4 capstan lathe when it is desired to thread work larger than 1 in. in diameter. The ordinary 1¼-in. die-head is too large to allow of rotating the turret, the purpose of the holder being to raise the head so that the turret may be swung. The slide carrying the head is raised by means of an eccentric operated by the handle at the top of the holder. A stop limits the downward travel of the slide.

Clip, paste on 3 x 5-in. cards and file as desired



THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	Current	One Year Ago
No. 2 Southern	$45.60	$29.80
Northern Basic	44.80	27.55
Southern Ohio No. 2	46.80	28.55
NEW YORK—TIDEWATER DELIVERY		
2X Virginia (Silicon 2.25 to 2.75)	52.65	31.90
Southern No. 2 (Silicon 2.25 to 2.75)	50.70	33.95
BIRMINGHAM		
No. 2 Foundry	42.00@44.00	25.75
PHILADELPHIA		
Eastern Pa., No. 2x, 2.25-2.75 sil.	47.00@49.50*	30.65
Virginia No. 2	47.00*	30.85
Basic	44.50†	29.90
Grey Forge	43.50*	29.90
CHICAGO		
No. 2 Foundry local	46.00	27.25
No. 2 Foundry, Southern	48.70	31.75
PITTSBURGH, INCLUDING FREIGHT CHARGE FROM VALLEY		
No. 2 Foundry	45.65	28.15
Basic	46.00	27.15
Bessemer	46.00@47.00	29.35
MONTREAL		
Silicon 2.25 to 2.75%	43.25	.....

* F.o.b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$4.47	$3.97	$3.47	$5.00	$3.37	$3.97	$3.47
Soft steel bars	4.62	4.12	3.37	4.50	3.27	3.87	3.37
Soft steel bar shapes	4.62	4.12	3.37	.....	3.27	3.87	3.37
Soft steel bands	6.32	5.32	4.07	6.25	.....	.....	.....
Plates, ¼ to 1 in. thick	4.67	4.17	3.67	4.50	3.57	4.17	3.67

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Mill, Pittsburgh	$4.25	$2.62
Warehouse, New York	4.57	3.37
Warehouse, Cleveland	3.52	3.22
Warehouse, Chicago	3.75	3.37

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Large Mill Lots Pittsburgh	New York Current	New York One Year Ago	Cleveland	Chicago
No. 10	3.55-7.00	7.12@8.00	4.57	8.10	7.02
No. 12	3.60-7.05	7.17@8.05	4.57	8.15	7.07
No. 14	3.65-7.10	7.22@8.10	4.67	8.20	7.12
No. 16	3.75-7.20	7.32@8.20	4.77	8.30	7.22
Black					
Nos. 18 and 20	4.20-6.20	8.30@9.80	5.30	8.70	7.80
Nos. 22 and 24	4.25-6.25	8.35@9.85	5.35	8.75	7.85
No. 26	4.30-6.30	8.40@9.90	5.40	8.80	7.90
No. 28	4.35-6.35	8.50@10.00	5.50	8.90	8.00
Galvanized					
No. 10	4.70-8.00	8.80@11.50	6.20	9.00	8.15
No. 12	4.80-8.10	8.90@11.50	6.25	9.10	8.20
No. 14	4.80-8.10	8.90@11.60	6.30	9.10	8.35
Nos. 18 and 20	5.10-8.40	9.15@11.90	6.60	9.40	8.65
Nos. 22 and 24	5.25-8.55	9.30@12.05	6.75	9.55	9.05
No. 26	5.40-8.70	9.45@12.20	6.90	9.70	9.20
No. 28	5.70-9.00	9.75@12.50	7.20	10.00	9.50

Acute scarcity in sheets, particularly black, galvanized and No. 16 blue enameled.

Automobile sheets are unavailable except in fugitive instances, when prices are 9.45c per lb. for No. 16; 9.50 for Nos. 18 and 20, and 9.55c for Nos. 22 and 24.

COLD FINISHED STEEL—Warehouse prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb. base	$6.25	$5.80	$6.00
Flats, square and hexagons, per 100 lb. base	6.75	6.30	6.50

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent.
New York	50
Cleveland	50
Chicago	50

NICKEL AND MONEL METAL—Base prices in cents per pound F.O.B. Bayonne, N. J.

Nickel	
Ingot and shot	43
Electrolytic	45

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	40
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55
Special Nickel and Alloys			
Malleable nickel ingots	45		
Malleable nickel sheet bars	47		
Hot rolled rods, Grades "A" and "C" (base)	60		
Cold drawn rods, grades "A" and "C" (base)	72		
Copper nickel ingots	42		
Hot rolled copper nickel rods (base)	52		
Manganese nickel hot rolled (base) rods "D" — low manganese	64		
Manganese nickel hot rolled (base) rods "D"— high manganese	67		

Domestic Welding Material (Swedish Analysis)—Welding wire in 100-lb lots sells as follows, f. o. b. New York: 1/16, 8½c. per lb.; ⅛, 8c.; 5/32 to ½, 7½c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	7.00	8.00	9.00
Spring steel (light)	10.00	11.00	12.25
Coppered bessemer rods	9.00	8.00	6.75
Hoop steel	6.57	6.50	5.32
Cold-rolled strip steel	12.50	8.25	10.75
Floor plates	6.80	6.00	6.77

PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card, discounts on steel pipe, applying as from January 14, 1920, and on iron pipe from January 7, 1920.

Inches	Steel Black	Steel Galvanized	Inches	Iron Black	Iron Galvanized
BUTT WELD					
⅛ to 3	54-57½%	41½-44%	⅛ to 1¼	24½-34½%	8 -18½%
LAP WELD					
2	47 -50½%	34½-38%	1¼	.....	.....
2½ to 6	50 -53½%	37½-41%	1½	.....	.....
7 to 12	47 -50½%	33½-37%	2	20½-28½%	6½-14½%
13 to 14	37½-41 %	.....	4½ to 6	22½-30½%	9½-17½%
15	35 -38½%	.....	2½ to 4	22½-30½%	9½-17½%
			7 to 12	19½-27½%	6½-14½%
BUTT WELD, EXTRA STRONG PLAIN ENDS					
⅛ to 1¼	52 -55½%	39½-43%	⅛ to 1¼	24½-34½%	9½-19½%
2 to 3	53 -56½%	40½-44%			
LAP WELD, EXTRA STRONG PLAIN ENDS					
2	45 -48½%	33½-37%	1¼	.....	.....
2½ to 4	48 -51½%	36½-40%	1½	.....	.....
4½ to 6	47 -50½%	35½-39%	2	21½-29½%	8½-16½%
7 to 8	43 -46½%	29½-33%	2½ to 4	23½-31½%	11½-19½%
9 to 12	38 -41½%	24½-28%	4½ to 6	22½-30½%	10½-18½%
			7 to 8	14½-22½%	2½-10½%
			9 to 12	9½-17½%	5½-+2½%

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
⅛ to 3 in. steel butt welded	40%	24%	40%	31%	54%40%	40½@30 %
2½ to 6 in. steel lap welded	35%	20%	42%	27%	50@40%	37½@27½%

Malleable fittings. Classes B and C, banded, from New York stock sell at plus 32%. Cast iron, standard sizes, net.

METALS

MISCELLANEOUS METALS—Present and past New York quotations in cents per pound, in carload lots:

	Current	Month Ago	Year Ago
Copper, electrolytic	19.00	19.25	21.75
Tin in 5-ton lots	49.00	61.50	70.00
Lead	9.50	9.00	5.50
Zinc	8.35	8.70	8.00
ST. LOUIS			
Lead	8.90	8.87½	5.25
Zinc	7.70@8.40	8.37½	7.65

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

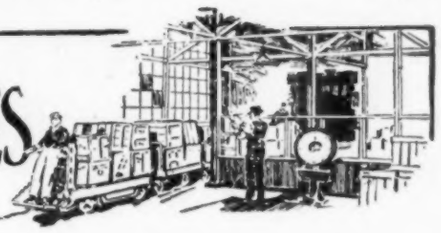
	New York Current	New York Month Ago	New York Year Ago	Cleveland Current	Cleveland Year Ago	Chicago Current	Chicago Year Ago
Copper sheets, base	33.50	33.50	29.50	34.00	33.50	36.00	36.50
Copper wire (carload lots)	31.25	31.25	26.50	29.00	29.50	27.00	25.00
Brass sheets	28.50	28.50	23.00	36.00	29.00	27.00	28.00
Brass pipe	33.00	33.00	34.00	34.00	36.00	35.00	37.00
Solder (half and half) (case lots)	38.00	33.00	45.00	40.50	41.00	38.00	41.00

Copper sheets quoted above hot rolled 16 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are for large lots, mill. 100 lb. and over, warehouse; net extra:

	Current	One Year Ago
Mill	25.00	19.00
New York	27.00	21.50
Cleveland	27.00	30.00
Chicago	29.00	30.00

SHOP MATERIALS AND SUPPLIES



ZINC SHEETS—The following prices in cents per pound are f.o.b. mill less 8% for carload lots 12.50

	Warehouse			
	—In Casks—		— Broken Lots —	
	Current	One Year Ago	Current	One Year Ago
Cleveland	15.00	12.50	15.50	13.00
New York	14.00	11.50	14.50	12.50
Chicago	15.00	16.50	15.00	16.00

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

	Current	One Year Ago
New York	7.50	9.50
Chicago	7.75	10.25

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	— New York —			
	Current	One Year Ago	Cleveland	Chicago
Copper, heavy, and crucible	16.25	17.00	15.00	15.50
Copper, heavy, and wire	15.25–15.75	16.00	14.50	15.00
Copper, light, and bottoms	13.00	14.00	13.00	14.00
Lead, heavy	7.25	4.75	7.00	7.50
Lead, tea	5.00	3.75	4.50	6.00
Brass, heavy	10.25	10.50	11.00	15.50
Brass, light	7.75–8.00	7.50	8.00	9.50
No. 1 yellow brass turnings	9.00–9.50	10.00	8.50	9.50
Zinc	5.25	5.00	4.50	5.50

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	$33.00	$33.00	$33.50

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York (round)	38.00	33.00
Chicago	29.00	31.00
Cleveland	34.00	35.00

BABBITT METAL—Warehouse price per pound:

	—New York—		—Cleveland—		— Chicago —	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Best grade	90.00	90.00	60.50	75.00	60.00	60.00
Commercial	50.00	50.50	21.00	16.50	15.00	13.00

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	—New York—		— Cleveland —		— Chicago —	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Hot pressed square	+ $6.00	$1.50	$ .50	$2.25	List	1.85
Hot pressed hexagon	+ 6.00	1.50	.50	2.25	List	1.85
Cold punched hexagon	+ 6.00	1.50	.50	2.25	List	1.30
Cold punched square	+ 6.00	1.50	.50	2.25	List	1.30

Semi-finished nuts, ⅜ and smaller, sell at the following discounts from list price:

	Current	One Year Ago
New York	30%	50–10%
Chicago	50%	50%
Cleveland	50%	60–10–10%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
½ by 4 in. and smaller	+ 20%	20%	20%
Larger and longer up to 1½ in. by 30 in.	+ 20%	20%	10%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... list Cleveland..... $2.50 Chicago..... $3.00

For cast-iron washers, ¼ and larger, the base price per 100 lb. is as follows:
New York..... $7.00 Cleveland..... $4.50 Chicago..... $4.75

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	+ 20%	35%	10%
Larger and longer up to 1 in. by 30 in.	+ 20%	20%	5%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets		Burs	
	Current	One Year Ago	Current	One Year Ago
Cleveland	20%	20%	10%	10%
Chicago	net	20%	net	20%
New York	25%	40%	net	20%

RIVETS—The following quotations are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	List Net	40%	30%
Tinned	List Net	40%	30%

Boiler, ¾, ⅞, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York..... $6.00 Chicago..... $5.62 Pittsburgh..... $4.5

Structural, same sizes:
New York..... $7.10 Chicago..... $5.72 Pittsburgh..... $4.60

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	$34.00	$36.00	$35.00
Brass	33.00	36.00	34.00

The prices, of course, vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1 c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities from 10-25 lb., extra is 10c.; less than 10 lb., add .15–20c.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ½-2 in. inclusive in rounds, and ½-1½ in., inclusive, in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $1.50.

LONG TERNE PLATE—In Chicago No. 28 prime from stock sell, nominally, for $12.50 per 100 lbs.

In Cleveland—$10 per 100 lbs.

COTTON WASTE—The following prices are in cents per pound:

	— New York —			
	Current	One Year Ago	Cleveland	Chicago
White	15.00@17.00	13.00	16.00	11.00 to 14.00
Colored mixed	9.00@14.00	9.00–12.00	12.00	9.50 to 12.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½x13½	13½x20½
Cleveland	55.00	65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$2.00	$3.00	$1.75
Philadelphia	2.75	2.75	1.75
Cleveland	3.00	2.50	2.75
Chicago	2.75	2.50	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$3.90	$3.90	$3.65
Philadelphia	3.65	3.65	3.62
Chicago	4.10	5.00	4.12½

COKE—The following are prices per net ton at ovens, Connellsville:

	August 30	August 23	August 16
Prompt furnace	$17.00@$18.00	$17.00@$18.00	$17.00@$18.00
Prompt foundry	18.00@20.00	18.00@20.00	18.00@20.00

FIRE CLAY—The following prices prevail:

	Per Ton	Current
Ottawa, bulk in carloads		$8.00
Cleveland	100-lb. bag	1.00

LINSEED OIL—These prices are per gallon:

	—New York—		—Cleveland—		—Chicago—	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Raw in barrels, (5 bbl. lots	$1.48	$2.25	$1.86	$2.15	$1.67	$2.48
5-gal cans, (without cans)	1.51*	2.40	2.15	2.40	1.92	2.68

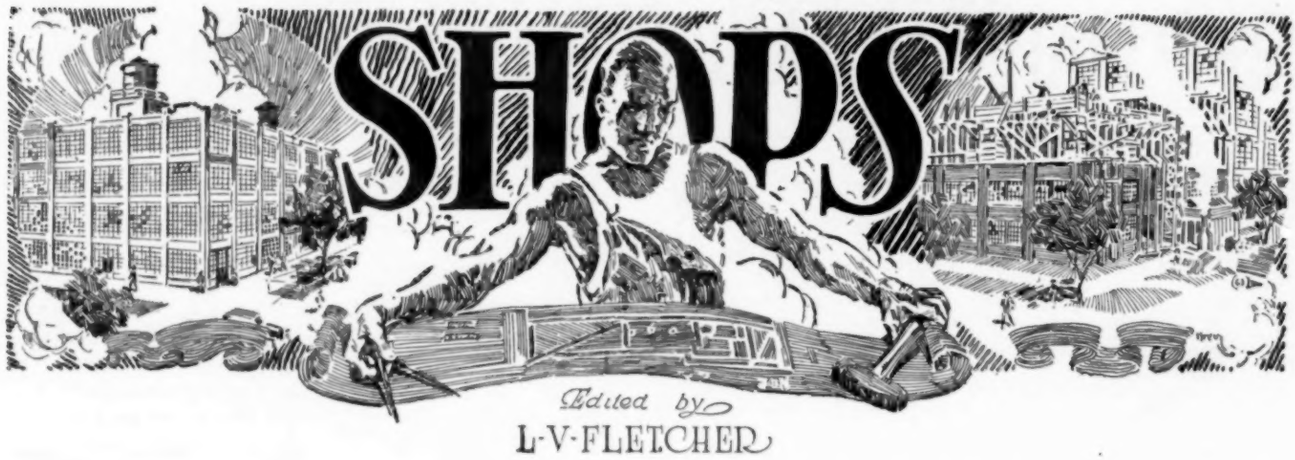
*To this *oil* price must be added the cost of the cans (returnable), which is $2.25 for a case of six.

WHITE AND RED LEAD—Base price per pound:

	— Red —				— White —	
	Current		One Year Ago		Current	One Year Ago
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100 lb. keg	15.50	17.00	13.00	14.50	15.50	13.00
25 and 50-lb. kegs	15.75	17.25	13.25	14.75	15.75	13.25
12½-lb. keg	16.00	17.50	13.50	15.00	16.00	13.50
5-lb. cans	18.50	20.00	15.00	16.50	18.50	15.00
1-lb. cans	20.50	22.00	16.00	17.50	20.50	16.00

500 lb. lots less 10% discount. 2000 lb. lots less 10–2½% discount.

NEW and ENLARGED



Edited by
L-V-FLETCHER

Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

Conn., Hartford—B. Martoocchio, 194 Copen St.—garage equipment.

Mass., Boston—The Boston Elevated Ry., 108 Massachusetts Ave., E. Mahler, Purch. Agt.—garage repair shop equipment.

Mass., Springfield—T. E. King, 107 Mulberry St.—garage equipment.

Vt., Hyde Park—The Belvidere Lumber Co.—heavy hand saw-rig, with 10-in. blades, right-hand make, complete (used).

Md., Baltimore—The Maryland Motor Car Co., 631 Munsey Bldg.—several internal grinding machines.

N. J., Atlantic City—The Roberts Mfg. Co., Hotel Belfort, 106 South Tennessee Ave.—power punches and foundry machinery for Tuckahoe, N. J., plant.

N. Y., Albany—The Federal Signal Co., Troy Rd.—miscellaneous machine tool equipment.

N. Y., New York (Borough of Manhattan)—The Equitable Motor Truck Co., 335 East 97th St.—presses, lathes and drills.

N. Y., Schenectady—The General Electric Co., River Rd.—one 20 in. upright drill with 2½ in. drill head and arranged for gear or belted motor drive.

Pa., Philadelphia—A. Box & Co., 1813 North Front St.—30-ton forcing press.

Pa., Philadelphia—The Dodge Steel Co., Morris Bldg.—Manning, Maxwell & Moore cold cut saw.

Pa., Philadelphia—J. G. Duncan Co., 1228 Race St.—garage equipment.

Pa., Philadelphia—J. Hiller, 1307 Stephen Girard Bldg.—heavy duty drill presses.

Pa., Philadelphia—The McCaffrey File Co., 5th and Berks Sts.—garage equipment.

Pa., Philadelphia—The National Umbrella Frame Co., 30th and Thompson Sts.—machine shop equipment.

Pa., Philadelphia—The Wright Roller Bearing Co., 20th and Indiana Sts.—Luster inspection tools.

Pa., Reading—The Reading Steel Casting Co.—machine tool equipment.

Pa., Scranton—S. Mintz, 404 Penn Ave.—one power press, equivalent to No. 72 B Toledo press (used).

La., New Orleans—The Motor Car Service Co., 1423 Canal St.—16-in. lathe.

La., New Orleans—I. Solomon, 1004 Pondras St.—lathe, striking tools, side cutters, cutting pliers.

Ill., Freeport—Hoefer Paper Co.—one No. 1 Fairwell gear hobber.

Mich., Ann Arbor—The Merco Engineering Co., P. C. Haas, Purch. Agt.—power punches, lathes, boring mills, one sawing machine, one mill cutter and vises.

O., Elyria—The H. and T. Spring Co., B. C. Heacock, Purch. Agt.—lathe, press, cutters, etc.

Wis., Milwaukee—The Milwaukee Ice Machine Co., 1001 Cold Spring Ave.—additional machine tools for manufacture of ice machines at its West Allis plant.

Wis., Milwaukee—S. K. Williams, 412 Montgomery Bldg.—one planer.

Wis., Racine—The perfex Radiator Co., 11th and Holmes Sts., back geared press with 5 or 6-in. stroke, similar to No. 75 Toledo or No. 6 Niagara.

Minn., Hancock—K. M. Knudsen—watchmakers lathe and instruments.

Mo., St. Louis—The Bowen Motor Ry. Co., Title Guarantee Bldg.—cranes, lathes, punches, planers, presses and small pneumatic tools.

Machinery Wanted

Conn., Middletown—A. Brazos & Sons, Inc., 68 Oak St.—Lane saw mill.

N. H., Franklin—H. L. Powell—light portable steam sawmill complete.

Md., Baltimore—The People's System of Bakeries, 106 North Charles St.—prices on bakery machinery, including moulders, proofers, etc.

N. Y., Astoria—The Astoria Silk Wks., 727 Steinway Ave.—weaving machinery for new mill at Cold Spring, N. Y.

Pa., New Castle—The Bd. of Educ.—work benches and machinery for manual training department.

Ill., Chicago—The Illinois Malleable Iron Co., 1801 Diversy Blvd.—one 10-ton traveling crane.

Ill., Decatur—The U. S. Wire Mat Co., 260 East Wood St.—woodworking machinery for turning handles.

Ind., Bedford—The Bedford Steel & Constr. Co., engrs., Bedford—catalogues on canning machinery and conveying systems.

Mich., Alma—F. W. Ruggles—special machinery for the manufacture of motor trucks, including lathes, presses and planers for plant in London, Ont.

Wis., Medford—The Northern Specialties Co., E. M. White, Purch. Agt.—woodworking machinery.

Wis., Milwaukee—The Milwaukee Grey Iron Fdry. Co.—T. Bentley, 609 Majestic Bldg.—mono rail crane.

Wis., Neenah—The Kimberly Clark Co.—traveling crane for Canada branch.

Minn., Minneapolis—The Franklin Co-operative Creamery Co., 26th St. and Franklin Ave.—$25,000 worth of power and refrigerating machinery.

Ont., Listowel—M. I. Adolph—complete machinery equipment for the manufacture of oil engines and farm power machinery.

Ont., Watford—The Andrews Wire Co., Wall St.—special machinery for manufacturing all kinds of wire products.

Metal Working

NEW ENGLAND STATES

Conn., Hartford—The S. K. F. Ball Bearing Co., 30 New Park Ave., has awarded the contract for the construction of a 1 story, 77 x 200 ft. factory. Estimated cost, $75,000.

Conn., Hartford—P. Ballotti & Son, 26 State St., will soon award the contract for the construction of a 1 story, 50 x 60 ft. garage on Otis St. Estimated cost, $10,000.

Conn., Hartford—B. Martoocchio, 194 Copen St., will build a 1 story, 50 x 50 ft. garage. Estimated cost, $10,000.

Conn., New Britain—The B. Jahn Mfg. Co., 6 Chestnut St., will soon award the contract for the construction of a 2 story, 40 x 150 ft. factory on Cherry and Ellis Sts. for the manufacture of dies, tools, etc. Estimated cost, $50,000. Noted July 10.

Conn., New London—F. Prottas, 317 Williams St., plans to build a 1 story garage at Ocean Beach. Estimated cost, $20,000.

Conn., Plantsville—The Atwater Mfg. Co. has awarded the contract for the construction of a 2 story, 62 x 80 ft. machine shop. Estimated cost, $50,000.

Conn., Portland—The Portland Fdry. Co., Freestone St., has awarded the contract for the construction of a 2 story, 40 x 50 ft. foundry addition at plant, here. Estimated cost, $50,000.

Conn., Waterbury—The Lux Clock Mfg. Co., 105 Sperry St., plans to build a 4 story factory. Private plans.

Conn., Waterbury—The Maltby Garage, 33 Union St., has awarded the contract for the construction of a 1 story, 65 x 200 ft. garage on East Main St. Estimated cost, $50,000.

Me., Biddeford—Cleaves & Sawyer, Saco, Me., have awarded the contract for the construction of a 1 story, 60 x 110 ft. garage on Elm St., here. Estimated cost, $25,000.

Mass., Holyoke—N. Robert, 72 Center St., has awarded the contract for the construction of a 1 story addition to his garage. Estimated cost, $12,000.

Mass., Mattapan (Boston P. O.)—J. Barrett, c/o A. D. Boyle, archt., 498 Norfolk St., will soon award the contract for the construction of a 1 story addition to his garage on Milton St. Estimated cost, $15,000.

Mass., Peabody—The A. C. Lawrence Leather Co., 161 South St., Boston, has awarded the contract for the construction of a 1 story, 70 x 70 ft. garage at plant. Estimated cost, $50,000.

Mass., Pittsfield—The General Electric Co. plans to build a 5 story, 70 x 400 ft. factory addition. M. M. Throne, care of owner, Engr.

Mass., South Hanover—R. C. Waterman Co., 101 Milk St., Boston, has awarded the contract for the construction of a 1 story factory. Estimated cost, $70,000.

Mass., Springfield—The Armory Square Realty Trust, 274 Main St., will build a 1 story, 80 x 125 ft garage on North Main St. Estimated cost, $75,000.

Mass., Springfield — J. Freedman, 80 Greenwood St., will soon award the contract for the construction of a 1 story, 85 x 170 ft. garage on Church St. Estimated cost, $25,000. J. W. Foster, 38 Stockman St., Archt.

Mass., Springfield—A. A. Geisel, 111 Magnolia Terrace, has awarded the contract for the construction of a 1 story, 60 x 120 ft. factory on Pecousic St., for the manufacture of motor truck parts. Estimated cost, $40,000.

Mass., Springfield—T. E. King, 107 Mulberry St., has awarded the contract for the construction of a 1 story, 70 x 100 ft. garage. Estimated cost, $15,000.

Mass., Springfield—The New York, New Haven & Hartford R.R., Meadow St., New Haven, Conn., has awarded the contract for improvements to its machine shops, etc., at freight yard on Water St., here. Estimated cost, $25,000.

Mass., West Springfield (Springfield P. O.)—The Springfield Automatic Screw Machine Corp. will soon award the contract for the construction of a 2 story factory. Estimated cost, $200,000. McClintock & Craig, 33 Lyman St., Springfield, Archts.

Mass., Worcester—H. Glick, 36 Portland St., plans to build a 2 story, 60 x 135 ft. garage addition. Estimated cost, $80,000. E. T. Chapin, 310 Main St., Archt.

MIDDLE ATLANTIC STATES

Maryland, Baltimore.—The Amer. Can Co., 120 Bway, New York City, plans to build a factory, here. Estimated cost, $500,000.

Md., Frederick—The Frederick Furniture Co., 43 Patrick St., will remodel a building and use same for the manufacture of furniture.

Md., Salisbury—W. F. Messick Ice Co. plans to establish a plant with 30 ton daily capacity and 3,000 ton storage capacity.

N. J., Hoboken—J. Paul plans to build a garage and show room at 6th and Washington Sts. Estimated cost, $45,000.

N. J., Homestead—The Amer. Chocolate Products Co., 206 Bway., New York City, will soon award the contract for the construction of a 5 story, 85 x 205 ft. factory at plant here. Estimated cost, $350,000. Andrews, Tower & Lavalee, 33 Lyman St., Springfield, Mass., Engrs. and Archts.

N. J., Trenton—The Amer. Bridge Co. is building a 60 x 221 ft. templet shop, 195 x 605 ft. main bridge shop, 78 x 198 ft. blacksmith shop and a 34 x 122 ft. paint shop. Estimated cost, $2,000,000.

N. J., Trenton—The Puritan Rubber Mfg. Co., Perrine Ave., will build a plant. Estimated cost, $7,000.

N. Y., New York (Borough of Brooklyn)—G. Simonelli, c/o G. Erda, Archt., 728 Manhattan Ave., will build a 1 story, 100 x 140 ft. garage on Morgan Ave. Estimated cost, $35,000.

N. Y., New York (Borough of Brooklyn)—J. Riley, care of H. Holder, archt., 242 Franklin Ave., will soon award the contract for the construction of a 1 story, 100 x 250 ft. foundry on Columbia St. Estimated cost, $250,000.

N. Y., New York (Borough of Brooklyn)—Charlotte Pl. Corp., c/o Shampan & Shampan, Engrs., 50 Court St., will build a 1 story, 90 x 100 ft. garage on Covert St. Estimated cost, $45,000.

N. Y., New York (Borough of Brooklyn)—J. F. Trommer Co., Inc., 1632 Bushwick Ave., will build a 2 story, 40 x 180 ft. garage. Estimated cost, $90,000.

N. Y., New York (Borough of Manhattan)—Dunnellen Constr. Co., 362 West 23rd St., will build a 1 story garage at 662 11th Ave. Estimated cost, $25,000.

N. Y., New York (Borough of Manhattan) J. P. Jacobs, 326 Audubon Ave., will build a 1 story, 100 x 250 ft. garage on Gerard Ave. and 149th St. Estimated cost, $100,000. H. J. Ozer, 1400 Bway., Engr. and Archt.

N. Y., Elmhurst—W. J. Muller will alter his 1 story garage. Estimated cost, $15,000.

N. Y., New York (Borough of Queens).—J. P. Conato, 8th St., Long Island City, will soon award the contract for the construction of a 1 story, 67 x 100 ft. garage. Estimated cost, $50,000.

Pa., Johnstown—The Knickerbocker Fuel Co., 1st Natl. Bank Bldg., plans to remodel and construct a 15 room addition to its present office building, also construct garage on Vine St. Estimated cost, $100,000. H. M. Rogers, Trust Bldg., Archt.

Pa., Kittanning—The Kittanning Iron and Steel Co. is having plans prepared for the construction of a 1 story addition to its plant. Estimated cost, $100,000. A. G. McKee Co., 2422 Euclid Ave., Cleveland, O., Engrs. and Archts.

Pa., New Castle—The Bd. of Educ. will soon award the contract for the construction of a 3 story, 248 x 340 ft. junior high school to include a manual training department. Estimated cost, $800,000.

Pa., Philadelphia—The McCaffrey File Co., 5th and Berks Sts., has awarded the contract for the construction of a 2 story, 80 x 80 ft. garage. Estimated cost, $25,000.

Pa., Philadelphia—The National Umbrella Frame Co., 30th and Thompson Sts., will build a 1 story, 50 x 50 ft. machine shop on Pennsylvania and Belfield Sts. Estimated cost, $5,000.

Pa., Pittsburgh — The Pittsburgh Forge and Iron Co., Chamber of Commerce Bldg., will soon award the contract for the construction of a 2 story, 18 x 22 ft. and 35 x 88 ft. coal mill building at its plant. Estimated cost, $40,000.

Pa., Reading—The Reading Steel Castings Co. has awarded the contract for the construction of a 1 story machine shop. Estimated cost, $200,000.

MIDDLE WEST

Ind., Michigan City—The Amer. Iron and Steel Corp. plans to build a 1 story concrete, brick and steel plant, to have 250 tons daily capacity, first unit to include 6 open-hearth furnaces, 12 mill sheet steel plant and other mills, for manufacture of plates, rods, bars, slabs, rails, wire and other direct and by-products of the industry. Total cost, $50,000,000. L. L. Slick, Engineers' Bldg., Cleveland, O. Dir. archt.'s name withheld.

Ind., Valparaiso—The Pioneer Truck Co. plans to build a 100 x 304 ft. factory for the manufacture of trucks. Estimated cost, $100,000. O. M. Frier, Pres.

Mich., Detroit—The Detroit Motor Bus Co., 1701 Dime Bank Bldg., plans to build a 1 story garage on Jefferson Ave.

Mich., Detroit—The Fort Shelby Garage, care of J. Gillespie, Fort Shelby Hotel, plans to build a 4 story, 130 x 150 ft. garage on Howard and 1st Sts. A. Kahn, Marquette Bldg., Archt.

O., Bedford—D. Round & Son Co. has awarded the contract for the construction of a 1 story, 90 x 120 ft. addition to its foundry at Stop 2. Estimated cost, $50,000.

O., Cincinnati—The Nash Motor Car Co., Gilbert Ave., has awarded the contract for the construction of a 2 story, 80 x 225 ft. garage, on Reading and Morgan Sts. Estimated cost, $150,000.

O., Cleveland—The Bd. of Educ., East 6th St. and Rockwell Ave., has awarded the contract for the construction of a 1 story, 40 x 200 ft. machine shop addition to its high school on Bway. and Fullerton Ave. Estimated cost, $1500,000. Noted May 13.

O., Cleveland—R. F. Carpenter Mfg. Co., 978 East 64th St., manufacturer of metal partitions, will build a 1 story, 14 x 37 ft. addition to its factory. Estimated cost, $5,000.

O., Cleveland—The Crossley Rubber Co., 1305 Prospect Ave., has awarded the contract for the construction of a 1 story, 30 x 50 ft. garage at 2170 East 18th St. Estimated cost, $10,000.

O., Cleveland—The Ferro Machine and Fdry. Co., East 66th St. and Hubbard Ave., has awarded the contract for the construction of a 1 story, 18 x 99 ft. garage. Estimated cost, $10,000.

O., Cleveland — The Rickersburg Brass Co., 3612 Perkins Ave., is building a 1 story addition to its foundry. Estimated cost, $5,000. A. Sickersberg, Pres.

O., Cleveland—M. Schmidt, 6305 Sargent Ave., will build a 1 story, 50 x 54 ft. garage at 11515 Lorain Ave. Estimated cost, $10,000.

O., Cleveland—A. Schmoldt, 1407 St. Clair Ave., has awarded the contract for the construction of a 1 story, 52 x 110 ft. addition to its garage at 1815 Oregon Ave. Estimated cost, $25,000.

O., Hamilton—The Herring-Hall-Marion Safe Co. plans to build a 2 story factory. Estimated cost, $75,000.

O., Massillon—The Lucius Reinforced Tank Co. has awarded the contract for the construction of a 1 story, 70 x 160 ft. factory. Estimated cost, $75,000.

O., Norwood (Cincinnati P. O.)—The Safe Cabinet Co. will soon award the contract for the construction of a 1 story, 80 x 150 ft. factory. B. L. Baldwin, 2nd Nat. Bank, Archt. and Engr.

O., Painesville—The Light Alloys Co. has awarded the contract for the construction of a 1 story, 75 x 140 ft. factory. Estimated cost, $65,000.

Wis., Janesville—The Sampson Motor Truck Co., is building a 70 x 200 ft. factory. A. J. Ferrielle, branch mgr.

WEST OF THE MISSISSIPPI

Col., Denver—The Western Mfg. Co., Evans Blk., plans to build a 1 story factory for the manufacture of locks and bolts. Estimated cost, $250,000.

Mo., St. Louis—The Bowen Motor Ry. Co., Title Guarantee Bldg., is having plans prepared for a factory. Estimated cost, $385,000. O. J. Popp, Odd Fellows Bldg., Archt.

CANADA

Ont., Brantford—The Caxslutt Plow Co. has awarded the contract for the construction of a 1 story, 70 x 200 ft. factory. Estimated cost, $75,000.

Ont., Ford City—The Fisher Body Co. of Canada plans to build a 4 story, 90 x 192 ft. factory for the manufacture of auto bodies, on St. Lukes Rd. A. Kahn, Walker Rd., Walkersville, Archt.

Ont., Kingston—The T. Watson Co., Woodstock, will soon award the contract for the construction of a factory here, for the manufacture of machinery. Estimated cost, $100,000.

Ont., Listowel—M. I. Adolph has purchased factory and plans to equip same for the manufacture of oil engines and farm power machinery.

Ont., London — F. W. Ruggles, Alma, Mich., will soon award the contract for the construction of the first unit of its auto truck factory on East London St., here. Estimated cost, $2,000,000.

Ont., Sudbury—The International Nickel Co. plans to build a rolling mill. Estimated cost, $3,000,000.

Ont., Tilbury—W. H. Hutton plans to take over factory and install new equipment for the manufacture of truck bodies. Estimated cost, $55,000.

Ont., Watford—The Andrews Wire Co., Wall St., will soon award the contract for the construction of a 60 x 150 ft. extension to its factory. Estimated cost, $50,000.

General Manufacturing

NEW ENGLAND STATES

Conn., New Haven—The New York, New Haven & Hartford R.R., Meadow St., has awarded the contract for remodeling machine shops, locker buildings and stockhouse; also building a 1 story, 100 x 120 ft. addition to the local freight yard. Estimated cost, $150,000.

Conn., Newtown—H. Curtiss & Sons Co. plans to build a 1 story factory on Foot Rd. for the manufacture of paper boxes. Estimated cost, $25,000.

Conn., Stamford—The Erskine Danforth Corp., 490 Pacific St., has awarded the contract for the construction of a 1 story, 60 x 100 ft. addition to factory for the manufacture of furniture. Estimated cost, $15,000.

Mass., Cambridge—The C. A. Briggs Co., 420 Main St., has awarded the contract for the construction of a 5 story, 90 x 180 ft., confectionery factory on Ames St. Estimated cost, $200,000.

Mass., Everett—The Boston Varnish Co., 2nd St., has awarded the contract for the construction of an 3 story, 60 x 100 ft. factory on East Sumner St. Estimated cost, $75,000.

Mass., Lynn—Hilliard & Merrill, Inc., 206 Broad St., manufacturer of soles, has awarded the contract for the construction of a 7 story, 130 x 480 ft. factory and warehouse on Eastern Ave. Estimated cost, $1,000,000.

Mass., New Bedford—The Nashawena Mills Co., Bellevue Ave., has awarded the contract for the construction of a 2 story, 70 x 150 ft. textile mill, at plant. Estimated cost, $100,000.

Mass., Plymouth—The Bradley Rug Co., Park Ave., has awarded the contract for the construction of a 2 story, 50 x 100 ft. factory. Estimated cost, $35,000.

Mass., Wrentham—The Commonwealth of Massachusetts, c/o Kendall Taylor & Co., Engrs. and Archts., 93 Federal St., Boston, will soon award the contract for the construction of a 1 story, 50 x 70 ft. cold storage building and a 1 story, 40 x 90 ft. industrial building at the State School, here. Estimated cost, $100,000. Noted May 6.

R. I., Auburn (Providence P. O.)—The Universal Winding Co. has awarded the contract for the construction of a 1 story and a 3 story addition to its plant. Estimated cost, $25,000 and $175,000, respectively.

R. I. Pawtucket—The Hope Webbing Co., 1005 Main St., plans to build a large addition to mill. Perry & Whipple, Rhode Island Hospital Trust Bldg., Providence, R. I. Engrs. and Archts.

Vt., Bellows Falls—The Liberty Paper Co., Inc., has awarded the contract for the construction of a 3 story, factory. Estimated cost, $130,000.

MIDDLE ATLANTIC STATES

Md., Baltimore—The Coca Cola Co., Pratt St. and Market Pl., has awarded the contract for the construction of a 4 story, 196 x 534 ft. coca cola factory and cooperage plant on Fort Ave. Estimated cost, $1,250,000.

Md., Baltimore—The Republic Belting Co., Pratt and Smallwood Sts., is remodeling a building and will use same for the manufacture of belting, etc.

Md., Crisfield—The Potomac Poultry Food Co., 802 Keyser Bldg., Baltimore, has awarded the contract for the construction of a 1 story, 125 x 144 ft plant here. Estimated cost, $150,000

Md., Curtis Bay (Baltimore P. O.)—The Union Acid Wks. has acquired a 250 x 520 ft. site on Aspen St. near Curtis Ave. and plans to extend its plant.

N. Y., New York (Borough of Brooklyn)—The Chapman Printing Co., c/o H. J. Nurich, Archt., 72 Bway., is having sketches made for a 1 story, 100 x 200 ft. printing plant on Morgan Ave. and Grand St. Estimated cost, $55,000.

Pa., Philadelphia—J. G. Duncan Co., 1228 Race St., has awarded the contract for the construction of a 2 story, 18 x 100 ft. sales and service building at 661 North Broad St.

Pa., Philadelphia—The Hellwig Silk Dyeing Co., 9th and Buttonwood Sts., has awarded the contract for the construction of a 2 story, 95 x 235 ft. factory on Homestead and Milnor Sts. Estimated cost, $90,000.

Pa., Philadelphia—The Philadelphia Felt Co. has awarded the contract for the construction of a 2 story, 52 x 68 ft. factory on Powder Mill Lane and Frankford Ave.

Pa., Pittsburgh—The Natl. Casket Co., Reedsdale St., has awarded the contract for the construction of a 2 story, 30 x 87 ft. addition to its factory. Estimaed cost, $30,000. Noted Aug. 26.

SOUTHERN STATES

Fla., Tampa—The Bd. of Port Comrs. are considering plans submitted by W. M. Black, for a terminal to include 850 ft. slip, warehouses on both sides, phosphate elevator, naval stores, general terminal facilities, machinery, etc. Estimated cost, $1,500,000.

Ky., Covington—The City Ice Co., 3210 Jefferson Ave., Cincinnati, O., has awarded the contract for the construction of an ice factory on Indiana and Scott Sts., here. Estimated cost, $30,000.

N. C., China Grove—United Mills Co., Hickory, plans to build a 1 story, 125 x 400 ft. cotton mill along the tracks of the Southern R.R. here. Estimated cost, $50,000.

MIDDLE WEST

Mich., Detroit—The Detroit Belt Lacer Co., 27 A St., has awarded the contract for the construction of a 2 story, 80 x 100 ft. belt-lacing factory. Estimated cost, $35,000. Noted Mar. 4.

O., Cincinnati—The C. F. Streit Mfg. Co., 1040 Kenner St., has awarded the contract for the construction of a 2 story, 31 x 50 ft. furniture factory.

O., Cincinnati—The Wheatley Pottery Co., Reading Rd., will soon award the contract for the construction of a 1 story factory, to have 45,000 sq.ft. floor space, on Lester Rd. Rendigs, Panzer & Martin, Palace Theatre Bldg., Archts.

O., Cleveland—J. A. Moffett, 1836 Euclid Ave., plans to build a 1 story, 32 x 40 ft. woodworking factory at 4539 Hough Ave. Estimated cost, $10,000. Private plans.

O., Cleveland—The Rie Armand Drug Co., 1234 St. Clair Ave., has awarded the contract for the construction of a 1 story, 33 x 47 ft. factory. Estimated cost, $10,000.

Wis., Sheboygan—The Sheboygan Parlor Furniture Co., South Water St., plans to build a 4 story, 60 x 174 ft. furniture factory. Estimated cost, $75,000. Juul & Smith, Imig. Bldg., Archts.

Wis., Sheboygan—The Wisconsin Textile By-Products Co., Calumet Drive, has awarded the contract for the construction of a 2 story, 60 x 187 ft. factory. Estimated cost, $30,000.

WEST OF MISSISSIPPI

Col., Denver — The Federal Glass Co., c/o Sylvester & Co., 1st National Bank Bldg., plans to build a plant to include office building, circular glass house, factory with 10,000 sq.ft. of floor space, and a gas plant. Estimated cost, $250,000.

Col., Denver—The Mountain States Packing Co., Gas and Electric Bldg., plans to build a packing plant adjoining their stock yards in the northeastern section of city. Estimated cost, $2,000,000.

Minn., Minneapolis—The Flour State Baking Co., 12th and Minnehaha Aves., has awarded the contract for the construction of a 4 story, 60 x 150 ft. bakery at 500 E. 37th St. Estimated cost, $250,000. E. C. Foley, Secy.

Minn., Minneapolis—The Franklin Cooperative Creamery Co., 26th St. and Franklin Ave., is having plans prepared for the construction of a 1 story, 64 x 85 ft. creamery. Estimated cost, $50,000. O. K. Westphal, 319 Kasota Bldg., Engr.

Minn., Winona—The Webster Woolen Mills, Rushford, is building a 3 story, 75 x 150 ft. factory, here. W. W. Webster, Mgr.

Mo., Aurora—The Juvenile Shoe Co., Advertising Bldg., St. Louis has had plans prepared for the construction of a factory here. Estimated cost, $60,000. T. P. Burnett Co., Arcade Bldg., Archts. and Engrs. Noted June 17.

Mont., Forsyth—The Montana Sugar Co. is having preliminary plans prepared for the construction of a sugar factory. Estimated cost, $1,500,000.

Okla., Henryetta—The Cogswell Refining Co. is having plans prepared for a 2,000 bbl. petroleum refinery. Estimated cost, $250,000. J. C. Bertsch, Tulsa, Engr.

Tex., Floydada—The Farmers' Gin Co. has awarded the contract for the construction of a 1 story factory, to have 6,134 sq.ft. floor space. Estimated cost, $30,000. About $16,000 worth of machinery will be installed.

CANADA

Que., Allard Falls—The Manouaw Pulp and Paper Co. will soon award the contract for the construction of a plant along the St. Maurice River, here. F. L. Moore, c/o Newton Falls Paper Co., Watertown, N. Y., is interested.

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